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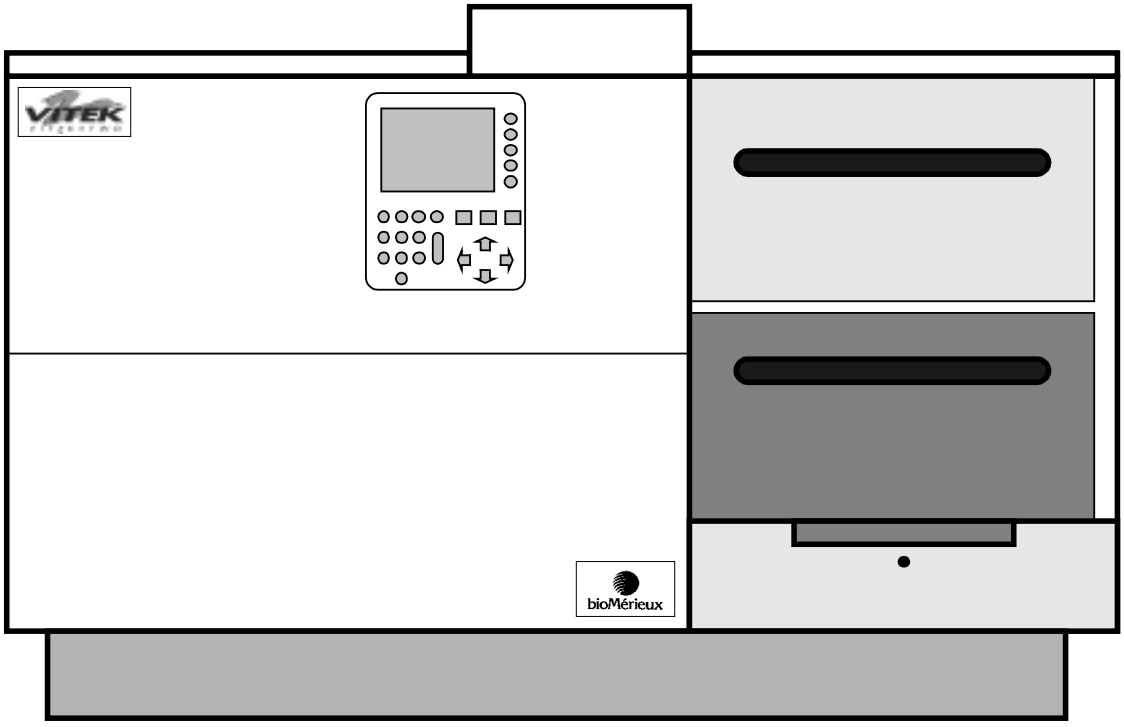

VITEK•2® & *VITEK•2® XL* INTEGRATED SYSTEM SERVICE MANUAL

510726-2
REV 0100

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PREFACE

This manual is for use by bioMérieux Field Service Engineers and Factory trained Biomedical Engineers to assist in the troubleshooting and repair of the ***VITEK•2®*** integrated system. Every effort has been made to ensure that the information contained in this manual is complete and accurate. All calibration and adjustment procedures used in this manual are adapted directly from current Engineering documentation.

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Chapter One: **Organization of the Manual**

Introduction

This Service Manual contains information on the operation, installation, maintenance, and repair of the ***VITEK•2®*** and the ***VITEK•2® XL*** integrated systems. This information is intended to provide an understanding of how these instruments perform, possible causes of malfunctions, and how to isolate and correct performance problems.

For practical purposes the"***VITEK•2®***" label will be used in this manual when information applies to both the ***VITEK•2®*** and ***VITEK•2® XL***. If there is additional or different information specifically for the XL, it will be denoted as "***VITEK•2® XL***".

This chapter explains how the manual is organized, and how to use the manual.

The Table of Contents lists all the chapters in this manual. Each chapter is subdivided into heading levels corresponding to a procedure or description.

Organization of the Manual

The information in the manual is organized into six chapters. They are arranged so that the information you need first is in the beginning of the manual. Information required for maintenance after the system is operating is found in later chapters. The following is a brief outline of what you will find:

- Chapter One: Organization of the Manual - This chapter explains how the manual is organized and how to use the manual.
- Chapter Two: System Setup - This chapter is a complete guide for the installation and setup of the ***VITEK•2®*** integrated system. It begins with the unboxing of the instrument and proceeds through its power-up and configuration.

  This chapter also contains environmental, spatial, and electrical requirements.
- Chapter Three: System Overview - This chapter introduces the ***VITEK•2®*** integrated system hardware and describes the basic parts of the software system.
- Chapter Four: System Components - This chapter describes the components of the system and their operation. It contains the descriptions of the boards and the major subassemblies.
- Chapter Five: Component Installation - This chapter describes how to remove, install, and mechanically align the subassemblies that may be encountered during repair of the ***VITEK•2®*** integrated system.
- Chapter Six: Troubleshooting – This chapter includes accessing and applying dml commands used in troubleshooting and diagnosing instrument failures, along with displaying system statuses.

This chapter also represents a General Troubleshooting Table for the ***VITEK•2®*** integrated system error detecting and reporting system. This Table lists the malfunctions and the actions to be taken.

Following these chapters are appendices listing procedures for decontamination/cleaning, board layouts and schematics, and alignment/calibration procedures. You will also find a glossary of terms in the back of the manual.

After completing this service manual, you should be able to do the following:

- Identify the ***VITEK•2®*** and the ***VITEK•2® XL*** integrated system instruments and independent subsystems
- Determine the instrument flow path and explain each subsystem operation
- Troubleshoot errors in the ***VITEK•2®*** integrated system module
- Determine and perform, alignment/calibration procedures for the ***VITEK•2®*** integrated system

After completing the various chapters in this manual, you should be able to complete the items listed under each chapter:

Chapter One

- You will be able to recognize the various typographic conventions used throughout the manual.

Chapter Two

- You will be able to describe how to unpack the ***VITEK•2®*** integrated system and prepare it for use.
- You will be able to identify, on sight, all of the ***VITEK•2®*** integrated system specifications.

Chapter Three

- You will be able to state the general operating theory of the ***VITEK•2®*** integrated system module.
- You will be able to describe the purpose of each of the following ***VITEK•2®*** subsystem stations:
  - ◊ User Interface System
  - ◊ Load/Unload Station
  - ◊ Cassette Scan Station
  - ◊ Dispenser/Pipettor Station
  - ◊ Vacuum Station
  - ◊ Card Sealer Station
  - ◊ Auto Loader & Reader/Incubator Station(s)
  - ◊ Waste Collection Station(s)

Chapter Four

- You will be able to identify the various internal components that make up the subsystems of the ***VITEK•2®*** integrated system.

Chapter Five

- You will be able to remove and install various components and subsystems of the ***VITEK•2®*** integrated system.

Chapter Six

- You will be able to access dml and apply commands to determine instrument statuses and troubleshoot problems.
- You will be able to identify a malfunction and the action required to fix it.

Typographic Conventions

Following are the terms and visual cues used in this manual to aid in your understanding of the procedures.

NOTE: This symbol calls attention to especially useful information or instructions.

WARNING! The information or instructions following is critical to the safe operation of the instrument. ***Please read this information carefully!***

The following data entry instructions are used throughout this manual:

- **ENTER key**. An instruction to use this key **ALWAYS** takes the form:

  press **ENTER**.

  NOTE: On some keyboards, this key may be labeled **RETURN**.

- **Function keys**. Function keys include all control keys, the **ESCAPE** key, the **CONTROL** key, and the **SHIFT** key. They are capitalized and appear as:

  press **CTRL U**.

- **Data Entry.** Data entered into the system via the keyboard is ALWAYS shown in **bold**. Instructions for making a data entry begin with "type" and conclude with "press **ENTER**."

An operation involving a selection always begins with "Select."

Single-key entries may not require pressing **ENTER**. Such entries begin with "press," such as:

press **Q**.

- **Commands.** From time to time, this manual may instruct you to enter a command on an external keyboard. An operation involving a command will appear in bold type. For example:

  Type **motor pump** and press **ENTER.**
  Press **<Ctrl X>**.

Chapter Two: **System Setup**

Preparations For Unpacking the *VITEK•2®* Integrated System

Inspect the shipping container for external damage. If damage to the shipping container has occurred, verify that the ***VITEK•2®*** integrated system has not been damaged. If damage to the ***VITEK•2®*** integrated system has occurred, file a claim with the shipper and notify bioMérieux, Inc.

Check the packing list and verify that all required items are included in the shipment.

Verify there is suitable bench space for the ***VITEK•2®*** (see Vitek 2 specifications).

Verify that the bench is capable of supporting the ***VITEK•2®***.

Verify the bench is level to within 2°.

NOTE: The packaging materials and shipping container should be retained for future transportation needs, if necessary.

WARNING! The ***VITEK•2®*** instrument weighs approximately 109 kg (240 lbs.). At least 2 people are required to lift or move the instrument.

WARNING! The ***VITEK•2® XL*** instrument weighs approximately 145 kg (320 lbs.). At least 2 people are required to lift or move the instrument.

WARNING! When lifting the instrument, it is essential that only the left and right hand hold pockets on the base pan are used. Otherwise severe damage can occur. (See Figure 2-1 for hand hold location.)

WARNING! The fastening straps may have sharp edges. Use extreme caution when handling the straps.

Unpacking Procedure

The recommended procedure for removing the ***VITEK•2®*** from its shipping container is to:

1. Cut the fastening straps that are wrapped around the shipping crate. Carefully remove and discard the straps.

2. Carefully remove the shipping container top from the bottom mounting skid and set aside. Be extremely careful to not damage the instrument or the container top.

3. With the container top removed, remove the shipping bag and any other shipping material.

4. With at least one person on each end, carefully lift the ***VITEK•2®*** using the hand hold pockets and move away from the bottom skid and end cap. Place the instrument in the desired location.

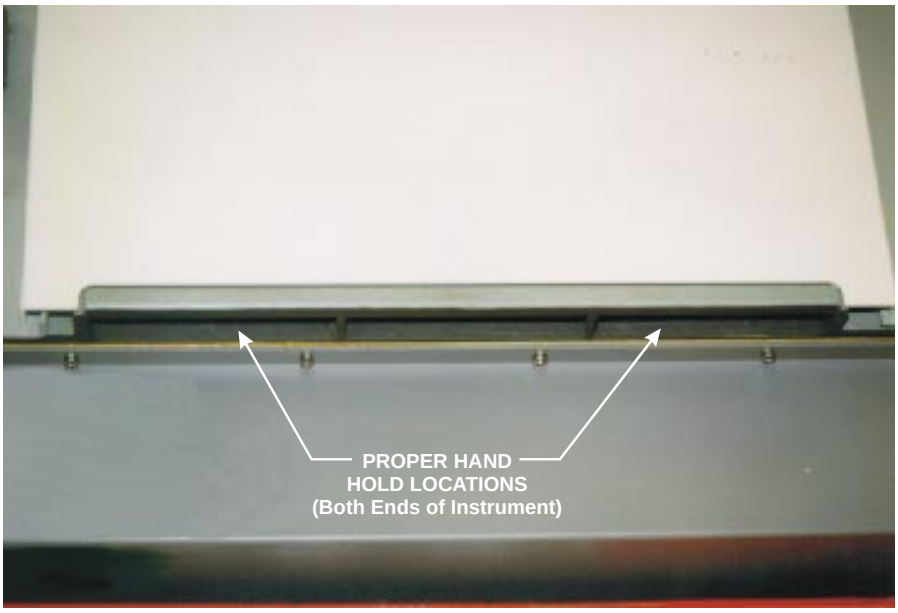


Figure 2-1 Proper Hand Hold Locations

Installation Procedure

After completing the unpacking procedure, the ***VITEK•2®*** integrated system is ready to be placed in its permanent location. The ***VITEK•2®*** is intended for use on any normal, flat bench top commonly found in the microbiology lab. The bench top must be capable of supporting the weight and size of the instrument.

The following should be performed in preparing the ***VITEK•2®*** integrated system instrument for use:

WARNING! The ***VITEK•2®*** instrument's power source must be properly grounded.

NOTE: See Appendix G for ***VITEK•2®*** Installation Checklist.

1. Place the ***VITEK•2®*** integrated system in its permanent location.

   - Position the instrument to meet the minimum clearance of 50 mm (2 in.) on all sides for ventilation and 50 cm (20 in.) above the instrument to provide necessary access for cleaning and maintenance.

2. Properly connect all cables except for the instrument communications cable, which connects the Work Station to the ***VITEK•2®***. This will be done after configuring the tty serial ports. (Refer to Figure 2-2 through 2-4 for cabling diagram.) See Table 2-1 for cable connection locations.

3. The Smart Carrier Station (SCS) can be placed in its working location connected only to a power outlet.

   - Turn on the SCS. The Configuration screen should be displayed. (If not, press **F2**.) Press the right arrow once and the Smart Carrier Firmware Status will be displayed. Record SCS Program Version. Press **F2** to exit.
   - Verify the button memory of all the cassettes by placing them on the SCS and confirming that Data Entry screen is displayed.
   - Verify the proper functioning of the bar code wand.
   - The SCS cable should be connected to tty0 and coiled up next to the Work Station. When a SCS firmware update is performed, the SCS will temporarily be connected to this cable (tty0) and then will be returned to its proper location.

Table 2-1 ***VITEK•2®*** Cable Connections

CONNECTIONS	***VITEK•2®*** CONNECTION LOCATION
Power Cable	Lower Left Side Panel, (standard universal IEC power connector)
UPS Interface	Left Corner Panel (9 pin, RS 232)
Computer Interface	Left Corner Panel (25 pin, RS 232)

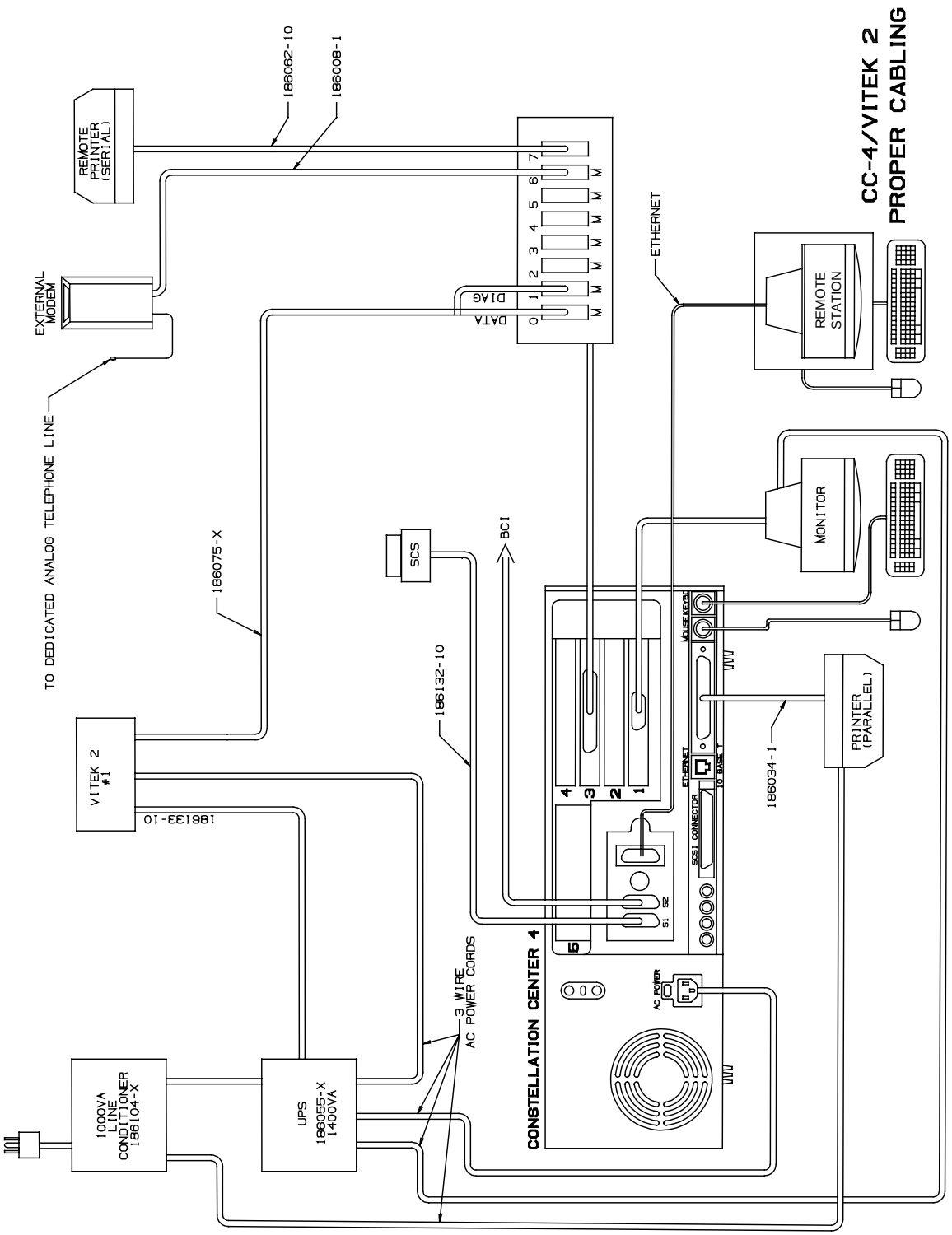


Figure 2-2 Cabling Diagram – One ***VITEK•2®*** Instrument

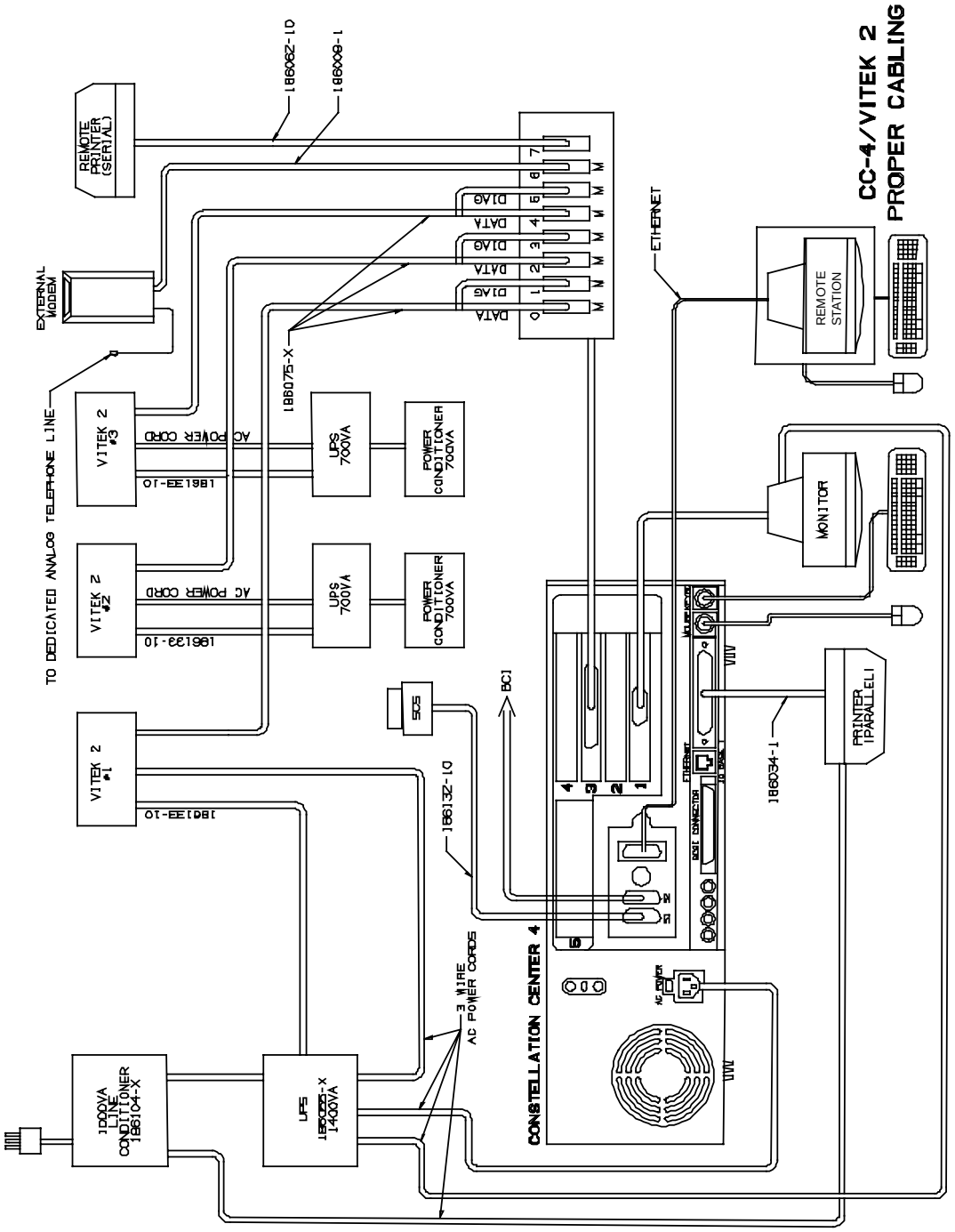


Figure 2-3 Cabling Diagram - Three ***VITEK•2®*** Instruments

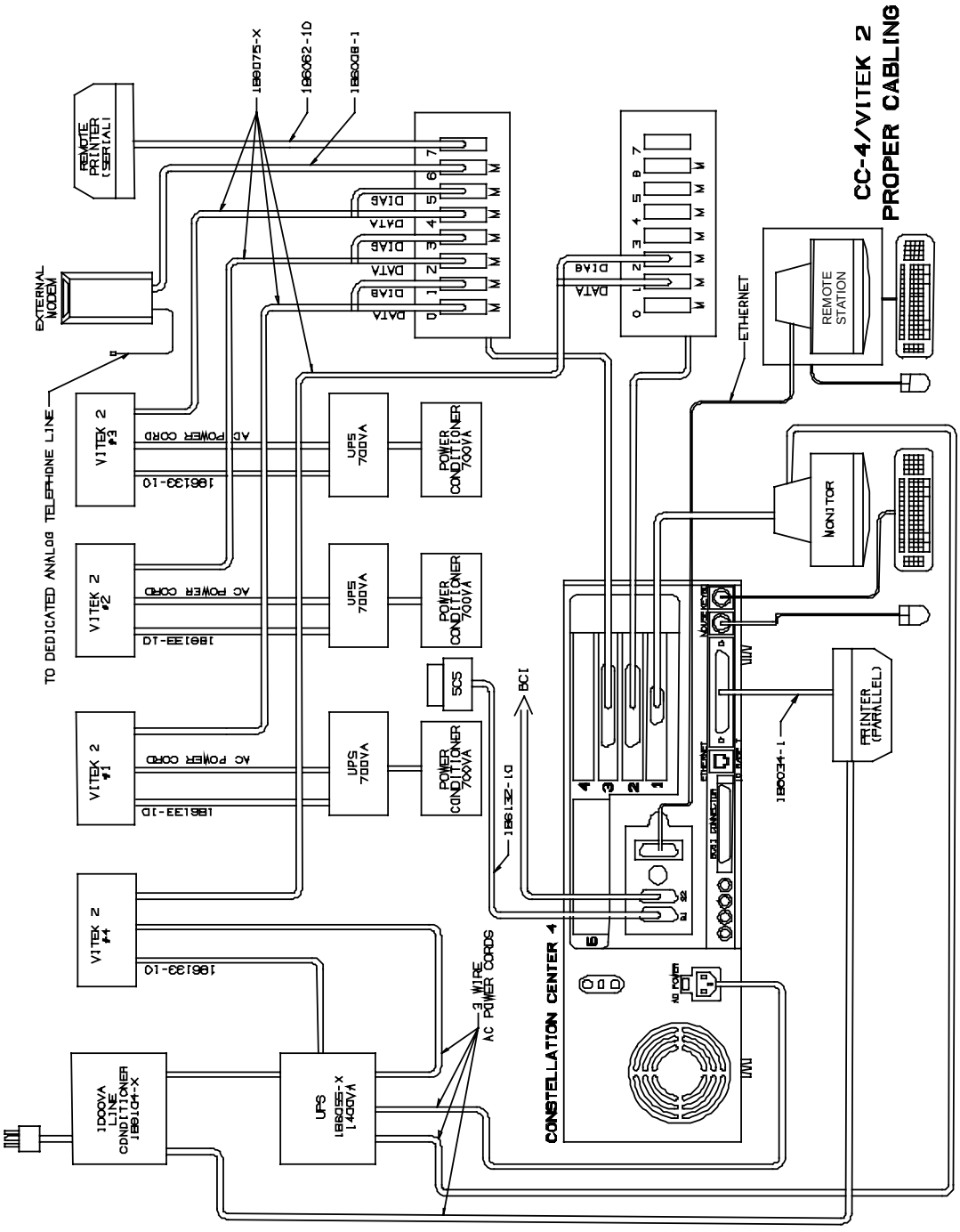


Figure 2-4 Cabling Diagram - Four ***VITEK•2®*** Instruments

3. Turn ON the ***VITEK•2®*** power. (***VITEK•2®*** power switch is located on the lower left side.)

4. Remove the shipping foam block from beneath the vacuum chamber and store it with the shipping container.

5. Clean the vacuum chamber seal and all top boat surfaces with a water dampened cloth or paper towel. Clean the transmittance and fluorescence arrays with a lint free lens paper or an alcohol wipe with the excess alcohol squeezed out, followed by lint free lens paper.

6. Install drum, magazine assembly and motor shield.

7. If the cleaning window is not displayed on the User Interface screen, from the Main Menu select Utilities, Maintenance, Cleaning and then Carousel Cleaning or Boat Cleaning. Follow the directions on the User Interface screen to install all four carousel quadrants and all four boats. (Refer to ***VITEK•2®*** User's Manual for detailed information.)

8. Install saline, dispensing tube assembly and pipette tips. (Refer to ***VITEK•2®*** User's Manual for proper procedure.)

Communication Configuration and Association

The Work Station must be configured properly to communicate with the ***VITEK•2®*** instrument. This includes setting up the logical tty device software for data as well as the diagnostics connection between the Work Station and the ***VITEK•2®***. (**NOTE**: The communications cable from the instrument to the Work Station should not be connected at this time.)

1. From the Command Terminal of the Work Station, type **vt2setup** and press **ENTER**. A series of options will be displayed. See Figure 2-5.

NOTE: The command vt2setup is case sensitive as well as all commands within vt2setup.

```
-- VITEK•2® Setup--

   1) tty configuration
   2) instrument association
   3) subsystem control
   Q) quit setup
```

Figure 2-5 ***VITEK•2®*** Setup Screen Options

2. In ***VITEK•2®*** Setup, type **1** and press **ENTER** for tty configuration. A device configuration window will be displayed similar to Figure 2-6.

```
---Device Configuration---

device   product  logical           modem    baud           data   stop
name     name     name     getty    control  rate   parity  bits   bits
tty0     VIT      tty0     disable  no       9600   none    8      1
tty1     BCI      tty1     disable  no       9600   none    8      1
tty2     VTK      tty2     enable   no       9600   none    8      1
tty3     VTK      tty3     enable   no       9600   none    8      1
tty4     VTK      tty4     enable   no       9600   none    8      1
tty5     VTK      tty5     enable   no       9600   none    8      1
tty6     SYS      tty6     enable   no       9600   none    8      1
tty7     SYS      tty7     enable   no       9600   none    8      1
tty8     SYS      tty8     enable   no       9600   none    8      1


Device name (<Q> to return):
```

Figure 2-6 Device Configuration Window

3. Type the device name that needs to be configured (i.e**. tty2**) and press **ENTER**. Follow the prompts to define the corresponding ***VITEK•2®*** tty ports for both data (VT2) and diagnostic (SYS) communication as shown in Table 2-2 and Figure 2-7. Also configure tty0 as VT2 for the SCS.

NOTE: Only define the ports for the ***VITEK•2*** and the SCS that are being installed**.**

Table 2-2 Proper TTY Connections

LOCATION	PHYSICAL PORT	LOGICAL NAME	INSTRUMENT / MODULE	CABLE	PRODUCT NAME
Work Station	1	tty0	Smart Carrier Station (SCS)	186132-10	VT2
Work Station	2	tty1	Bi-directional Computer Interface		BCI
#1 POD	0	tty2	1st Installed ***VITEK•2®***	186075-X Data	VT2
#1 POD	1	tty3	1st Installed ***VITEK•2®***	186075-X Diagnostic	SYS
#1 POD	2	tty4	2nd Installed ***VITEK•2®***	186075-X Data	VT2
#1 POD	3	tty5	2nd Installed ***VITEK•2®***	186075-X Diagnostic	SYS
#1 POD	4	tty6	3rd Installed ***VITEK•2®***	186075-X Data	VT2
#1 POD	5	tty7	3rd Installed ***VITEK•2®***	186075-X Diagnostic	SYS
#1 POD	6	tty8	External Modem	186008-1	SYS
#1 POD	7	None	Optional - remote printer	186062-X	
#2 POD	0	tty9	Available		
#2 POD	1	tty10	4th Installed ***VITEK•2®***	186075-X Data	VT2
#2 POD	2	tty11	4th Installed ***VITEK•2®***	186075-X Diagnostic	SYS

```
---Device Configuration---

device   product  logical          modem    baud           data   stop
name     name     name     getty   control  rate   parity  bits   bits
tty0     VT2      tty0     disable no       19200  none    8      1
tty1     BCI      tty1     disable no       9600   none    8      1
tty2     VT2      tty2     disable no       19200  none    8      1
tty3     SYS      tty3     disable no       9600   none    8      1
tty4     VTK      tty4     enable  no       9600   none    8      1
tty5     VTK      tty5     enable  no       9600   none    8      1
tty6     SYS      tty6     enable  no       9600   none    8      1
tty7     SYS      tty7     enable  no       9600   none    8      1
tty8     SYS      tty8     enable  no       9600   none    8      1


Device name (<Q> to return):
```

Figure 2-7 Device Configuration Window

4. Once the data, diagnostic and SCS ports have been defined, type **q** and press **ENTER** to return to ***VITEK•2®*** Setup. Then type **3** and press **ENTER** for Subsystem Control. A series of options will be displayed. (See Figure 2-8)

```
Subsystem Control

   1) start instrument daemons
   2) stop instrument daemons
   3) stop all background daemons
   4) list daemons
   Q)return to main menu
```

Figure 2-8 Subsystem Control

5. Type **1** and press **ENTER** to start instrument daemons. Then press **ENTER** to return to Subsystem Control.

6. Next type **q** and press **ENTER** to return to ***VITEK•2®*** Setup.

7. Physically connect the communication cable from the ***VITEK•2®*** instrument to the appropriate tty ports on the Work Station.

8. Type **2** and press **ENTER** for Instrument Association. See Figure 2-9. Instrument Association has four columns. The first column header is labeled #. This label is the identification for the buttons on the ***VITEK•2®*** Work Station software. The second column is labeled Instrument. This is the corresponding serial number of the Bay Controller Board (BCB) on each ***VITEK•2®*** attached to the Work Station. The third is labeled Name. This is the instrument name given to the ***VITEK•2®*** by the operator. The last is labeled Device. This is referencing which serial port the data cables are connected. (**NOTE:** It may take several minutes to display the ***VITEK•2®*** instrument on the Instrument Association window.)

```
---Instrument Association---
#  instrument     name           device
1  000001108B7E   1101           /dev/tty2
2  000001FCE913   1151           /dev/tty4
```

Figure 2-9 Instrument Association

9. First type the corresponding instrument BCB serial number located in the instrument column and press **ENTER**. Next type 1-4 and press enter to associate this instrument with the first, second, third or fourth button to be displayed on the ***VITEK•2®*** Software Directory window. "Updating database" will appear for a few minutes. Press **q** and **ENTER** to exit from Instrument Association and press **q** and **ENTER** to exit from ***VITEK•2®*** Setup.

10. Verify the instrument association by pressing the ***VITEK•2®*** button on the Main Menu of the Work Station and then select the corresponding instrument button.

Remote Diagnostics Setup

WARNING! For security purposes the external modem MUST be turned **OFF** when not in use by authorized bioMérieux personnel.

Configure Work Station for External Modem

1. From the Work Station computer, open the Change/Show Characteristics of a tty window. (From the Main Menu select System, System Maintenance and Change/Show Characteristics of a TTY.)

2. Configure tty8 port as shown in Table 2-3. (Refer the bioLaiason User Manual for instruction.)

Table 2-3 tty8 Modem Configuration

TTY8:	**tty8**
Product:	**SYS**
Unique ID:	**tty8**
Login state:	**enable**
Modem Control:	**yes**
BAUD rate:	**19200**
PARITY:	**none**
BITS per character:	**8**
Number of STOP BITS:	**1**

Configure US Robotics 33.6 Faxmodem

1. Verify modem is connected to Work Station. See Figure 2-2 through Figure 2-4 for cabling diagram.
2. Ensure that modem switches **3, 5** and **8** are in the down position and all the others are in the up position.
3. Turn the external modem ON.
4. Open a command terminal window from the Work Station computer. (From the Main Menu select System, System Maintenance, Command Terminal , OK.)
5. At the dms> prompt type **su** and press **ENTER**.
6. At the password prompt type **vitek** and press **ENTER** . The cursor should be displayed next to the pound (#) prompt.
7. At the pound prompt type **kermit -c -l /dev/tty8** and press **ENTER**. Kermit will connect to the tty8 port and display a speed of 19200 baud. A solid red cursor will also be displayed.

8. Type **at&f2&n10&u4** and press **ENTER**. The monitor should display the response OK. (If there is no response, exit from kermit and check all connections and settings.)

NOTE: These settings configure the modem to answer at 19,200 baud rate or lower with software flow control.

9. Type **at&w** and press **ENTER** to save the settings. The monitor should again display the response OK.
10. Exit from kermit by pressing the **CTRL** and **** keys simultaneously, immediately followed by the letter **c**.
11. Exit from the Command Terminal window.
12. Turn the external modem off.
13. Place all the modem switches in the up position.
14. Turn the external modem on.
15. Connect the modem to a dedicated analog phone line and label the modem with the corresponding phone number.

Verify Remote Diagnostics

1. Connect PC modem to a separate analog phone line.
2. Open Hyper Terminal or an equivalent communications software package on the PC.
3. Configure the communication package COM port as follows:
   - Terminal - VT100
   - Baud Rate – (as required)
   - Parity - None
   - Data Bits - 8
   - Stop Bits - 1
4. Dial the ***VITEK•2***® system modem phone number and wait for a connection. A **login** prompt will appear if connected successfully.
5. When **login** appears, type **dms** and press **ENTER.**
6. When **password** appears, type **dms** and press **ENTER.** The **dms** prompt should appear.
7. From the **dms** prompt connect to the corresponding ***VITEK•2***® diagnostic port. This would be accomplished by typing either **dml1, dml2, dml3** or **dml4** and press **ENTER**. (See Table 2-4.)

Table 2-4 Remote Diagnostic Connection

INSTRUMENT	PHYSICAL DIAGNOSTIC CONNECTION	COMMAND TO TYPE
1	tty3	**dml1**
2	tty5	**dml2**
3	tty7	**dml3**
4	tty11	**dml4**

8. Press the **SPACE** and the **BACKSPACE** key to display the instrument diagnostic prompt. (**WARNING:** Pressing the **ENTER** key will execute the last command the instrument was given.)
9. To disconnect the diagnostics, press the **CTRL** and **** keys simultaneously, immediately followed by the letter **c**.
10. To disconnect from the Work Station, at the dms prompt type **exit** and press **ENTER**.
11. Turn the external modem OFF.

Verify Proper Operation and Alignment of *VITEK•2®*

1. From the main menu of the ***VITEK•2®*** user interface screen select Utilities and then Diagnostics. Verify the proper functioning of the Optics, Card Transport and Vacuum by selecting the corresponding options.

2. Open a diagnostics window from the Work Station by doing the following:
   From the Main Menu select System, System Maintenance and Diagnostics. Then select the corresponding tty communication port. Click **EXECUTE**. A diagnostic window should now be displayed. Press the **ESCAPE** key twice to display the prompt. (**WARNING:** Pressing the **ENTER** key will execute the last command the instrument was given.)

3. Verify the system status from the diagnostic window prompt by typing **sys_status** and press **ENTER**. Verify that there are no Error Codes and that all the required components for the ***VITEK•2®*** are Installed & Functional. (See Figures 2-10 and 2-11 for an example.)

```
VTK2 A > sys_status
     Component | Installed | Functional | Error Codes
      Reader A |       Yes |        Yes |
     Stacker A |       Yes |        Yes |
  Autoloader A |       Yes |        Yes |
   Incubator A |       Yes |        Yes |
    HCB Head A |       Yes |        Yes |
   TX 1 Head A |       Yes |        Yes |
   TX 2 Head A |       Yes |        Yes |
   TX 3 Head A |        No |         No |
     FL Head A |       Yes |        Yes |
      Reader B |        No |         No |
     Stacker B |        No |         No |
  Autoloader B |        No |         No |
   Incubator B |        No |         No |
    HCB Head B |        No |         No |
   TX 1 Head B |        No |         No |
   TX 2 Head B |        No |         No |
   TX 3 Head B |        No |         No |
     FL Head B |        No |         No |
       Diluter |       Yes |        Yes |
      Pipettor |       Yes |        Yes |
        Vacuum |       Yes |        Yes |
        Sealer |       Yes |        Yes |
     Transport |       Yes |        Yes |
  Touch Memory |       Yes |        Yes |
      Bar Code |       Yes |        Yes |
   Inside Temp |       Yes |        Yes |
     Host Comm |       Yes |        Yes |
    Power Fail |       Yes |        Yes |
      Low Batt |       Yes |        Yes |
```

Figure 2-10 ***VITEK•2®*** With TX1, TX2 & Fluorescence Installed

```
VTK2 A > sys_status
     Component | Installed | Functional | Error Codes
      Reader A |       Yes |        Yes |
     Stacker A |       Yes |        Yes |
  Autoloader A |       Yes |        Yes |
   Incubator A |       Yes |        Yes |
    HCB Head A |       Yes |        Yes |
   TX 1 Head A |       Yes |        Yes |
   TX 2 Head A |       Yes |        Yes |
   TX 3 Head A |        No |         No |
     FL Head A |       Yes |        Yes |
      Reader B |       Yes |         No |
     Stacker B |       Yes |        Yes |
  Autoloader B |       Yes |        Yes |
   Incubator B |       Yes |        Yes |
    HCB Head B |       Yes |        Yes |
   TX 1 Head B |       Yes |        Yes |
   TX 2 Head B |        No |         No |
   TX 3 Head B |        No |         No |
     FL Head B |        No |         No |
       Diluter |       Yes |        Yes |
      Pipettor |       Yes |        Yes |
        Vacuum |       Yes |        Yes |
        Sealer |       Yes |        Yes |
     Transport |       Yes |        Yes |
  Touch Memory |       Yes |        Yes |
      Bar Code |       Yes |        Yes |
   Inside Temp |       Yes |        Yes |
     Host Comm |       Yes |        Yes |
    Power Fail |       Yes |        Yes |
      Low Batt |       Yes |        Yes |
```

Figure 2-11 ***VITEK•2®*** **XL** with TX1, TX2 & Fluorescence Installed in Section A and TX1 Installed in Section B

4. Verify proper functioning of the instrument circulation fans at the diagnostic window prompt by typing **fan 100** and press **ENTER**. Verify the left fans blows into the instrument and the right fan blows outward. In approximately one minute the fan will default back to its appropriate speed based on the ambient temperature of the instrument.

5. Type **ver** at the diagnostic prompt and record the firmware versions of Bay Controller Board (BCB), SPN & Boot. (This can also be found at the instrument by selecting Utilities, Diagnostics, and Version Information from the main menu of the user interface screen.)

6. Verify incubator temperature at the diagnostic window prompt by typing **pr $ave_incu_temp** and press **ENTER**. See specifications described later in the chapter. (This can also be accomplished at the instrument by selecting Utilities, Diagnostics, and Temperature from the main menu of the user interface screen.) When the instrument reaches it's required average incubator temperature, the instrument Status will change from WARMING to OK.

☞ **NOTE:** The ***VITEK•2®*** is given 30 minutes to reach the proper temperature. If the instrument was cold, the heater may time out before this is accomplished. To verify, use the **incu_stat** command. If the heater drive is 0%, perform an **init_heater** or a **cold** and monitor the temperature.

7. Verify vacuum by connecting a tee fitting to a Absolute Pressure Gauge. Carefully disconnect the small vacuum line coming from the pressure transducer on the Vac Seal SPN board and connect it to one end of the tee. Connect the other end of the tee to the same fitting that the tubing was originally attached. Square a boat against the back left transport rails. From the diagnostics window type **vac_cycle** and press **ENTER**. This runs a standard vacuum cycle. Verify the chamber runs through a complete cycle and the 0.89 ± 0.04 PSIA specification is met. If it is not, perform the Vacuum Transducer Calibration procedure found in Appendix E: Alignment Procedure.

8. Process engineering test card and verify proper alignment and operation of instrumentation. (Refer to Appendix E.)

   a) If not already displayed, open the Work Station Diagnostics window.

   b) Verify/change the cassette mode to cassette only. (From the User Interface main menu select Utilities, Configuration, Cassette Mode and Cassette Only.)

   c) Verify/change the dilution mode to automatic. (From the User Interface main menu select Utilities, Configuration, Dilution Mode and Automatic.)

   d) Setup engineering test cards, tubes and liquid in a cassette as shown in Figure 2-12 ***VITEK•2®*** & ***VITEK•2® XL*** (Section A) Engineering Test Card Arrangement.

If the alignment is being verified for a ***VITEK•2® XL***, also setup engineering test cards in a cassette as shown in Figure 2-13 ***VITEK•2® XL*** (Section B) Engineering Test Card Arrangement.

e) Insert the loaded cassette in the Load / Unload Station and close door.

f) Visually check the operation of the ***VITEK•2®*** as the cards are moved from one station to the next and note any problems or misalignments.

g) Once the cards have loaded into the carousel verify carousel alignments and note any problems or misalignments.

h) If the ***VITEK•2® XL*** alignment is being verified, perform steps e-g again using the second prepared cassette.

i) Once cards have been successfully loaded into the carousel(s) and the alignments have been verified, unload the cards as described below. Watch the unloading process and verify the proper height and left/right adjustment of the waste collection station.
   - If unloading a ***VITEK•2®***, type **unload flush_carousel** and press **ENTER**.
   - If unloading a ***VITEK•2® XL***, type **cara a** and press **ENTER**. At the carousel A prompt type **unload flush_carousel** and press **ENTER**. Next type **cara b** and press **ENTER**. At the carousel B prompt type **unload flush_carousel** and press **ENTER**.

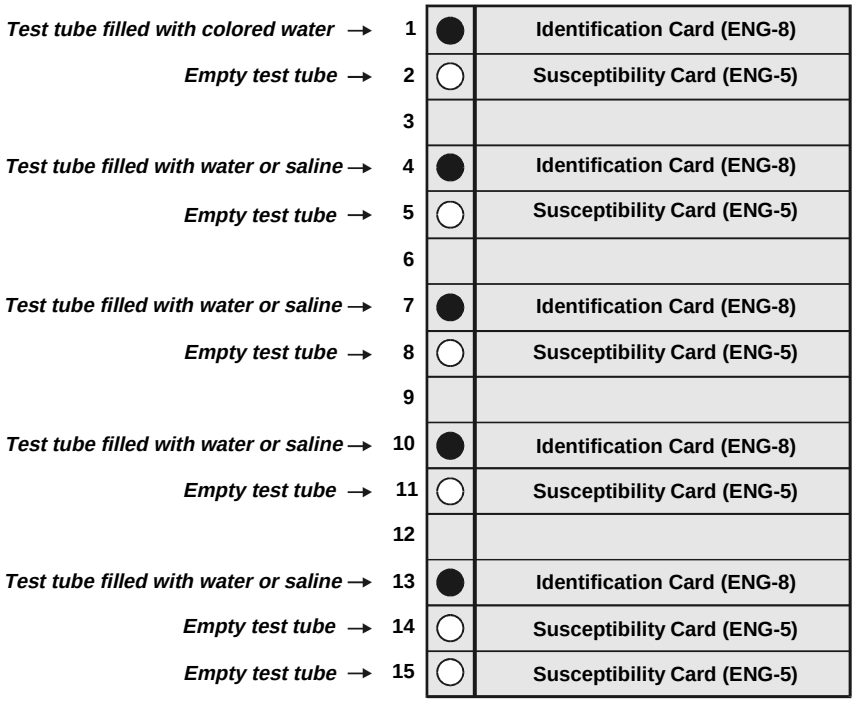

Test tube filled with colored water → 1 Identification Card (ENG-8)
Empty test tube → 2 Susceptibility Card (ENG-5)
3
Test tube filled with water or saline → 4 Identification Card (ENG-8)
Empty test tube → 5 Susceptibility Card (ENG-5)
6
Test tube filled with water or saline → 7 Identification Card (ENG-8)
Empty test tube → 8 Susceptibility Card (ENG-5)
9
Test tube filled with water or saline → 10 Identification Card (ENG-8)
Empty test tube → 11 Susceptibility Card (ENG-5)
12
Test tube filled with water or saline → 13 Identification Card (ENG-8)
Empty test tube → 14 Susceptibility Card (ENG-5)
Empty test tube → 15 Susceptibility Card (ENG-5)

Figure 2-12 ***VITEK•2®*** & ***VITEK•2® XL*** (Section A) Engineering Test Cards Arrangement

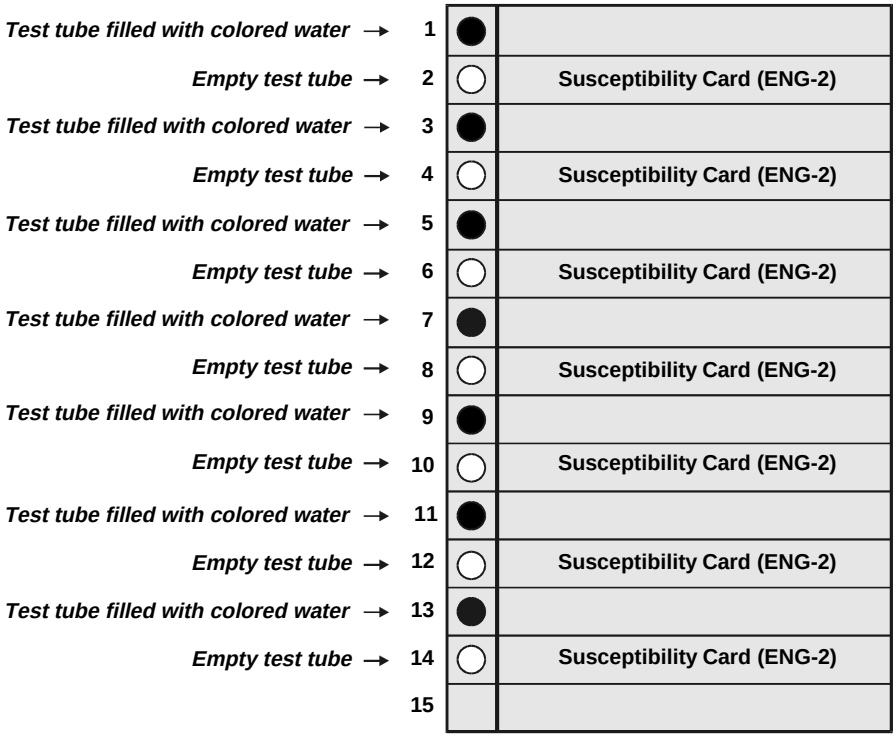

Test tube filled with colored water → 1
Empty test tube → 2
Susceptibility Card (ENG-2)
Test tube filled with colored water → 3
Empty test tube → 4
Susceptibility Card (ENG-2)
Test tube filled with colored water → 5
Empty test tube → 6
Susceptibility Card (ENG-2)
Test tube filled with colored water → 7
Empty test tube → 8
Susceptibility Card (ENG-2)
Test tube filled with colored water → 9
Empty test tube → 10
Susceptibility Card (ENG-2)
Test tube filled with colored water → 11
Empty test tube → 12
Susceptibility Card (ENG-2)
Test tube filled with colored water → 13
Empty test tube → 14
Susceptibility Card (ENG-2)
15

Figure 2-13 ***VITEK•2®XL*** (Section B) Engineering Test Card Arrangement

9. Perform ***VITEK•2®*** Fluorescence Optics Calibration Procedure (Follow procedure in Appendix F).

10. From the diagnostic window, Default the instrument settings by typing **inst_defaults** and press **ENTER**.

11. Type **cold** and press **ENTER**. Verify instrument initializes properly and no errors occur.

Specifications

The ***VITEK•2®*** integrated system has the following features and capabilities:

CAPACITY: 4 Cassettes
60 cards maximum for ***VITEK•2®***
120 cards maximum for ***VITEK•2® XL***

DILUTER: Dispensing; 2.33 ml – 2.63 ml disposable shot tube
Capacity; 1000 ml (bag), user replaceable

PIPETTOR: Volume; 100µl to 300µl ± 5% or ± 5µl whichever is greater
Capacity; 350 pipette tips maximum, user loaded

VACUUM: Draw down; -0.6 PSI/sec. max.
Minimum Pressure; 0.89 ± 0.06 PSIA
Return to atmosphere; +0.10 to +3.5 PSI/sec.

SEALER: Stub length 0.025 mm to 2.5 mm, Sealed

INCUBATOR: Temperature; 35.5°C ± 1°C (Average)
Capacity; 60 cards for ***VITEK•2®***
120 cards for ***VITEK•2® XL***

OPTICS: Transmittance:

- LED's emission wavelengths; 660nM, 568 nM
- % transmission range 30% to 100% ± 10%
- Reads each card once every 15 minutes
- 8 channels (columns 1-8 for rows 1-8, 64 wells total)

Fluorescence:

- Emission wavelength, 365 nM
- Detection wavelength, 445 nM
- 6 channels (2-7 for rows 1-8, 48 wells total)
- Calibration: 3,800 RFU ±5% with 5µM 4-MU in CHES @ pH 9.6
- Lamp Life 30 million flashes minimum
- Self checking and calibrating using internal reference
- Reads each card once every 15 minutes

WASTE CAPACITY: 60 cards maximum for ***VITEK•2®***
120 cards maximum for ***VITEK•2® XL***
Up to 1 liter of fluid in drip pan

ENVIRONMENTAL: Operating Ambient temperature; 20°C to 30°C measured within 5cm of instrument (68ºF to 86ºF)
Humidity; 40% to 80% (non- condensing)
Altitude up to 2000 m.
Indoor use only.

Instrument Physical and Electrical Requirements

PHYSICAL CHARACTERISTICS:

Dimensions;

VITEK•2®

- Height - 67 cm (26.3 in)
- Width - 100 cm (39.4 in)
- Depth - 71 cm (27.7 in)

VITEK•2® XL

- Height - 67 cm (26.3 in)
- Width - 140 cm (55.1 in)
- Depth - 71 cm (27.7 in)

Clearance;

- 5 cm (2 in) minimum on all sides
- 50 cm (20 in) minimum above the top of the cabinet doors

Weight;

VITEK•2®

- 110 kg. (240 lb.)
- Left and right side lift pockets (2 people min.)

VITEK•2® XL

- 145 kg. (320 lb.)
- Left and right side lift pockets (2 people min.)

ELECTRICAL REQUIREMENTS:

Voltage Selection;

- Externally selectable at universal power switch fuse block

Input voltages;

- 100/120 VAC & 200/240 VAC
- 50/60 Hz

Maximum Current;

VITEK•2®

- 4 amps @ 120VAC or 2 amps @ 240 VAC

VITEK•2® XL

- 5.2 amps @ 120 VAC or 2.8 amps @ 240 VAC

Nominal Current;

VITEK•2®

- 1.5 amps @ 120VAC or 0.75 amps @ 240 VAC

VITEK•2® XL

- 2.75 amps @ 120 VAC or 1.75 amps @ 240 VAC

Power;

- ***VITEK•2®***: 150 watts nominal, 480 watts peak
- ***VITEK•2® XL***: 200 watts nominal, 480 watts peak

Heat;

- ***VITEK•2®***: 512 BTU/HR (nominal)
- ***VITEK•2® XL***: 682 BTU/HR (nominal)

ELECTRICAL REQUIREMENTS: (con't)

Power Fail;

- External UPS backup @ 700VA minimum
- Automatic power down mode using external UPS provided signals (power fail, battery low)

Chapter Three: **System Overview**

Unit Description

The ***VITEK•2®*** is a fully automated bacteriological testing system. This design integrates sample preparation, incubation, and optical measurement systems into a single instrument for use in the identification and susceptibility testing of microorganisms.

Automation provided by the ***VITEK•2®*** includes preparation of the patient isolate, transfer of fluid to the test card, loading the card into the optical reader/incubator, and disposing of the card once the test is complete. This instrument is comparable to the existing Vitek susceptibility test methods. Enhancements to the optical system provides multi-wavelength capability.

Figure 3-1 shows the ***VITEK•2®*-60** integrated system instrument.

Figure 3-2 shows the ***VITEK•2®*-120** integrated system instrument.

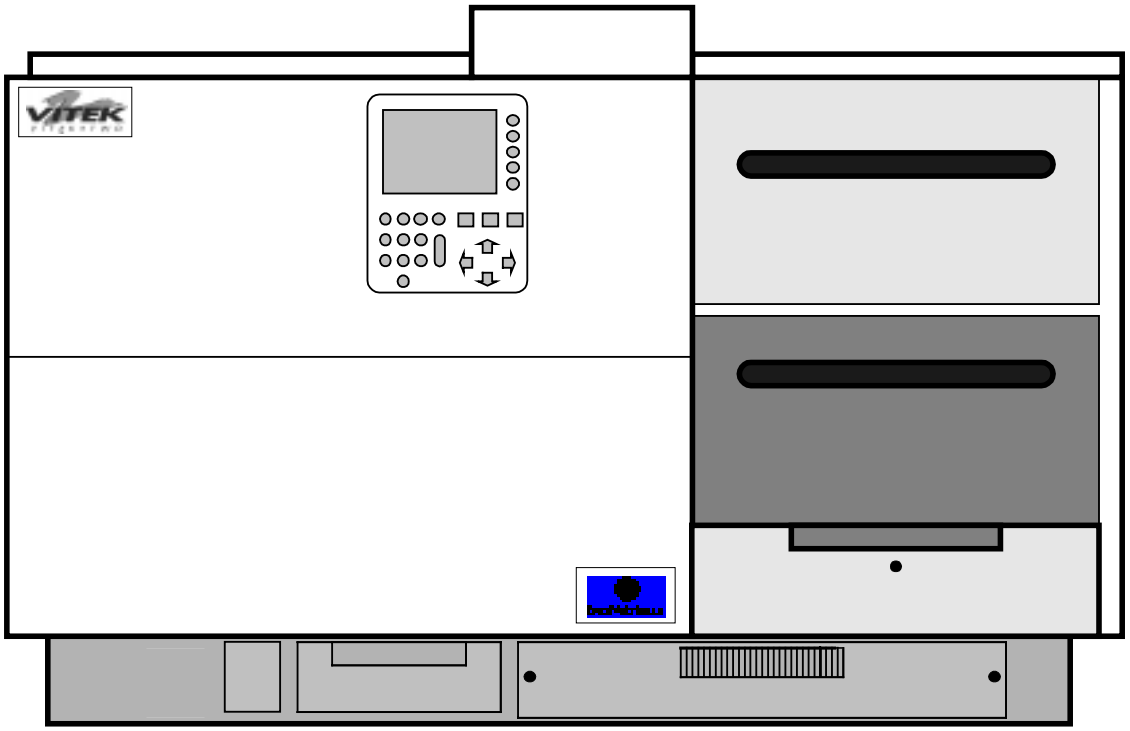


Figure 3-1 ***VITEK•2®*-60** Integrated System Instrument

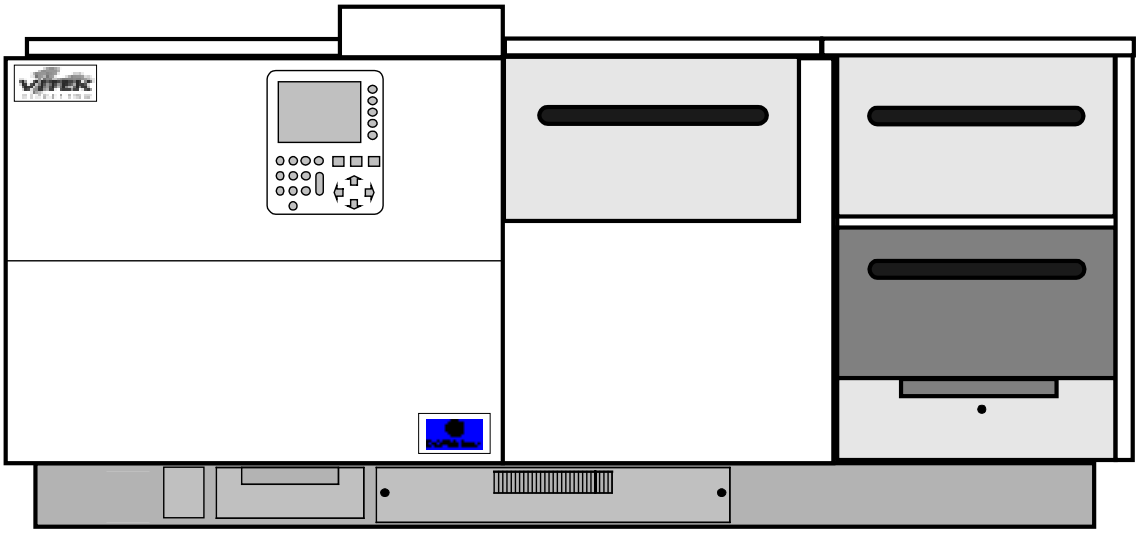


Figure 3-2 ***VITEK•2®*-120** Integrated System Instrument

System Operation

The ***VITEK•2®*** integrated system is a combination of several independent stations working together to optically scan test cards within a controlled temperature environment. The major subsystem stations of the instrument are the load/unload station, cassette scan station, dispenser/pipettor station, vacuum station, card sealer station, autoloader & reader/incubator station, and waste collection station.

The LCD User Interface control panel, located on the front of the instrument, allows operator access through menu functions for normal setup and operation, and specific menus for maintenance and troubleshooting.

The internal layout of the ***VITEK•2®*** consists of several sample processing stations and a reader/incubator. Test cards, tubes with patient isolates, and empty tubes for susceptibilities will be loaded into cassettes by the operator. Then the cassettes of cards will be placed into a carrier in the instrument called the Smart Carrier Boat Assembly.

The Transport System automatically moves the boat and cassette past several independent subsystem stations. An operation description of each subsystem will be discussed in this chapter. Component parts of each subsystem are discussed in Chapter Four.

Figure 3-3 and Figure 3-4 illustrates a block diagram of the ***VITEK•2®*** instrument transport system flow and station locations.

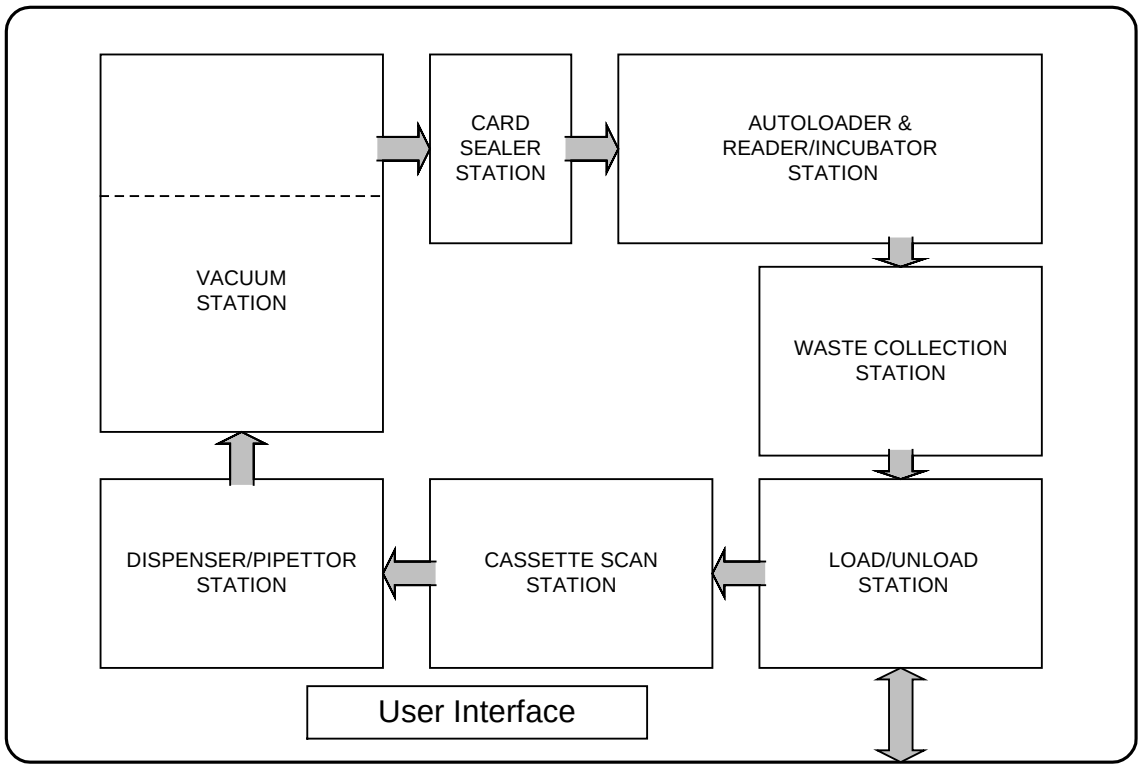


Figure 3-3 ***VITEK•2®*** **-60** Station Block Diagram

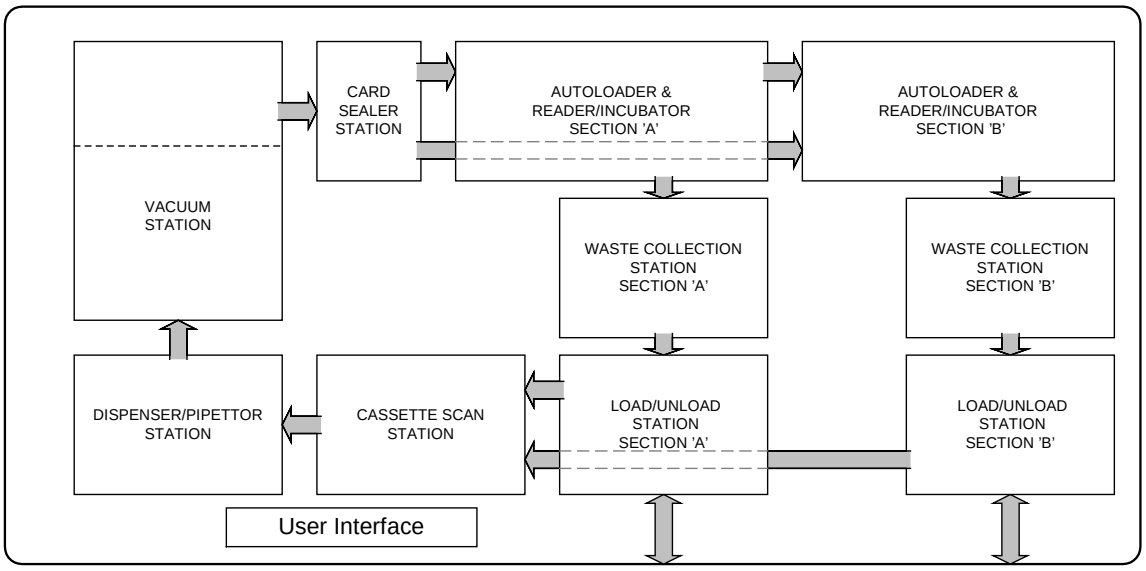


Figure 3-4 ***VITEK•2®*** **-120** Station Block Diagram

User Interface System

A keypad and screen, shown in Figure 3-5, are located on the front of the ***VITEK•2®***. The ***VITEK•2®*** uses the screen to send you messages about its operation, on-board disposables, and possible problems. You use the keypad to respond to ***VITEK•2®*** instructions, send commands to the ***VITEK•2®***, and perform other functions.

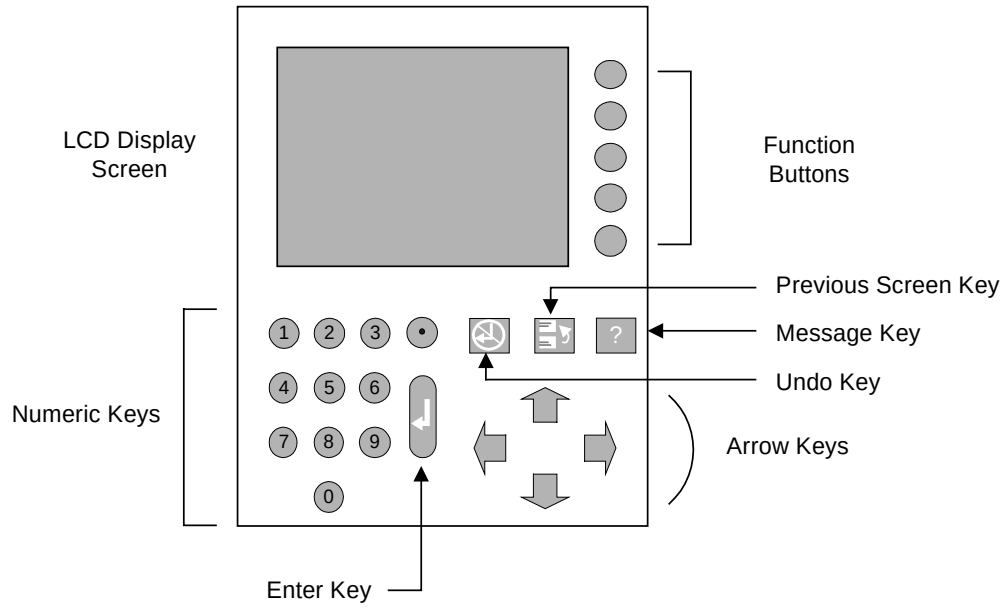


Figure 3-5 User Interface Keypad and Screen

The user interface keypad and screen have the following components :

FUNCTION Buttons	Use these buttons to select menu options or other specified functions.
HELP Key	Press this key anytime to access the message queue.
PREVIOUS SCREEN Key	Use this key to: ♦ Exit this screen or function to its menu ♦ Return to a previous screen in a function ♦ Go from a sub menu to its previous menu ♦ Go from the Main Menu to the Status Screen
UNDO Key	Use it to cancel the last action performed.
ARROW Keys	Use these keys to: ♦ Scroll a screen or menu ♦ Move the cursor on some screen **NOTE:** When ARROW keys are active, there icons appear on the display
ENTER Key	Use this key to complete data entries, or when instructed to do so on the screen.
NUMERIC Keys	Use these keys to enter a number onto a screen.

Load/Unload Station

The Load/Unload Station is where the operator loads Smart Carrier Cassettes to start the test card preparation process. The cassettes are pre-loaded outside of the instrument with tubes of patient isolates, susceptibility dilution tubes (if needed), and 64 well test cards.

Loaded cassettes are placed into boats within the instrument. The boats provide overflow areas to capture liquid spillage and a sealing surface for the vacuum fill cycle. The boat normally remains in the system but is removable for cleaning.

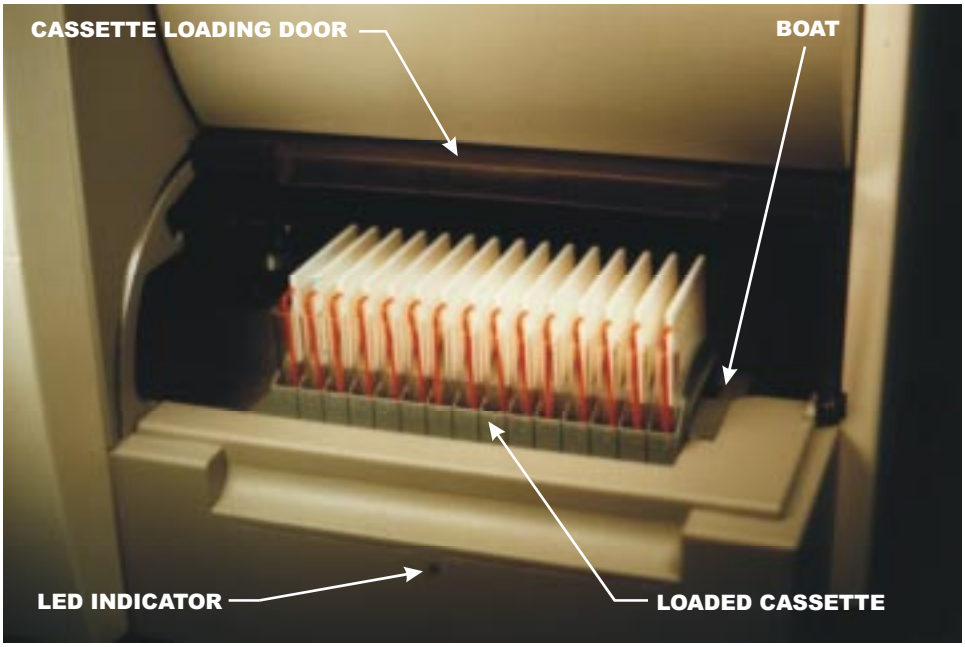


Figure 3-6 Load/Unload Station

Cassettes are loaded into a boat through an open door at the Load/Unload Station (see Figure 3-6). A green LED below the load/unload station is illuminated when the instrument is ready to accept a cassette. Once the cassette is loaded onto the boat and the operator closes the cassette loading door, the door locks and the green LED will go out. At this point, test card processing automatically initiates. (The cassette loading door remains locked whenever a boat is moving through the Load/Unload Station.)

Once the cards have been processed and loaded into the incubator, the boats return the cassettes containing processed patient isolate tubes to the Load/Unload Station for removal from the system. The cassette will be parked at the cassette loading door with the door unlocked and the operator notified by the "flashing" load/unload LED. The operator can then remove the cassette and dispose the processed test tubes. The boat will remain in place for the next cassette, or it will advance to make room for the next processed boat to come forward to the unload station.

Cassette Scan Station

Patient identification test data entry may be made prior to placing the cassette into the instrument using an external Smart Carrier Station (SCS). A "button" memory device within the cassette will be used to carry this information from the SCS to the ***VITEK•2®*** instrument.

For installations without a SCS, a "Cassette Only Mode" will allow the user to load cassettes that do not have cassette memory. Information required to run the test is included in a bar code on the card. The user will then be required to manually link the test card bar code to the patient at the computer workstation prior to processing the data from the cards.

Refer to Figure 3-7 for the location of the Cassette Scan Station.

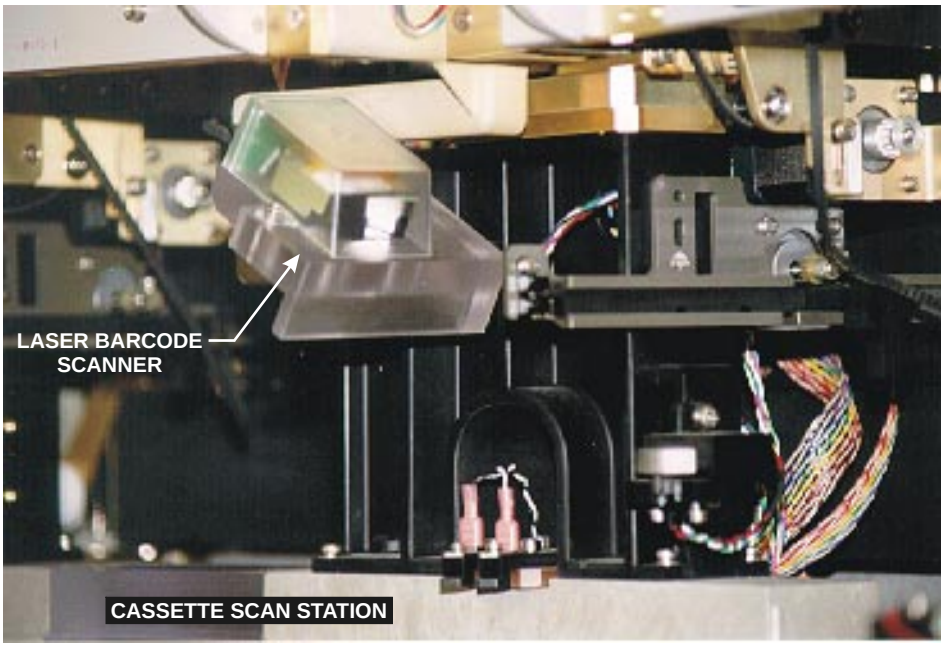


Figure 3-7 Cassette Scan Station

Laser Bar Code Scanner

Each card will have a bar code that includes information such as test type, lot number, expiration date, and a unique sequence number. A laser bar code scanner at the Cassette Scan Station is provided to read the card type to determine the proper dilution volume and optics scan method. This scanner provides an additional level of security by verifying cards are loaded as indicated by the user in the cassette "button" memory, if a SCS is used.

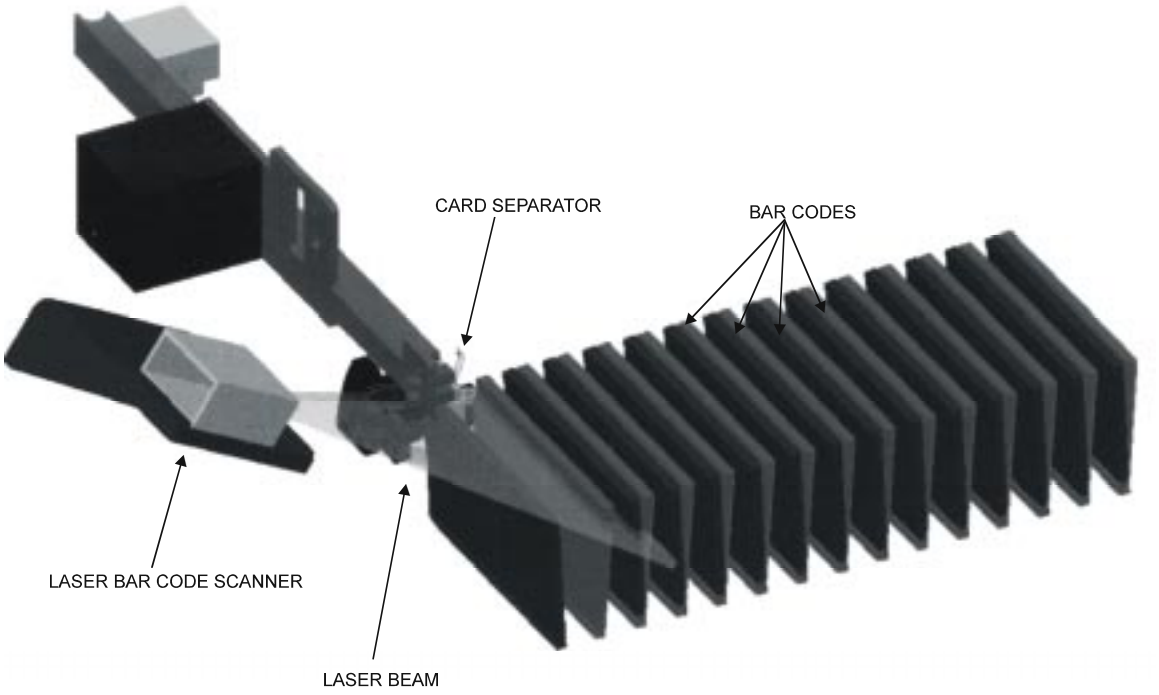


Figure 3-8 Laser Bar Code Scanner

As the transported cassette and cards enter the Cassette Scan Station area, a spring loaded, cam shaped, card separator makes contact and positions the card to be scanned (Figure 3-8). When the card approaches, the card separator cam moves into the path of a sensor, detecting that the card is present. The scanner triggers to read or look for the bar code information on a card for each slot of the cassette. Each card is positioned and read as the cassette moves through this station. See Figure 3-9.

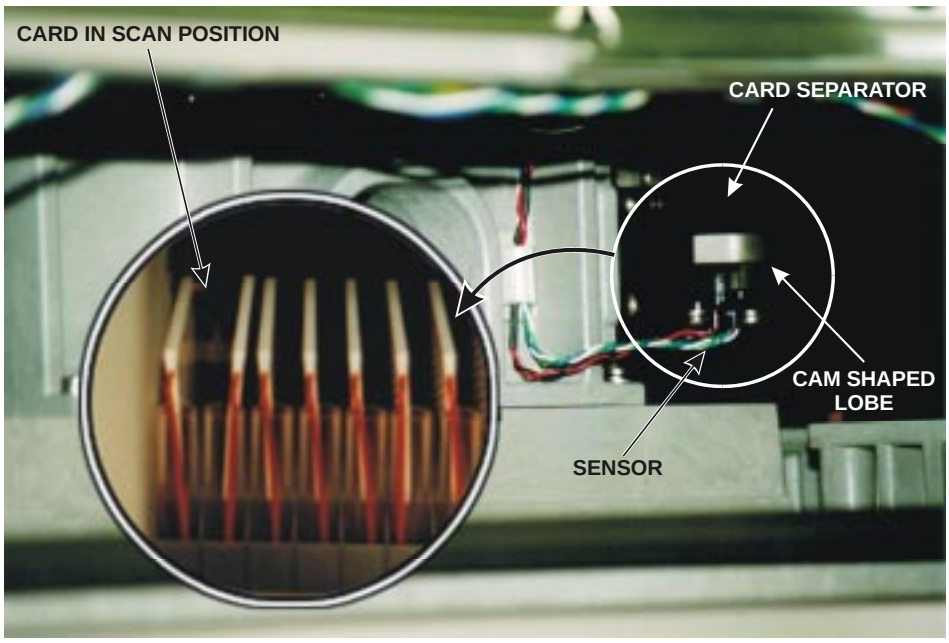


Figure 3-9 Card Separator

Cassette Memory

As the last card in the cassette is scanned, the cassette is positioned at the "button" memory device (Figure 3-10). If the ***VITEK•2®*** was previously set-up in Smart Carrier Cassette Mode and the "button" memory device was programmed at the Smart Carrier Station, the Cassette Scan Station will read the memory. This non-volatile memory device contains the patient, test, and carrier specific information for the system.

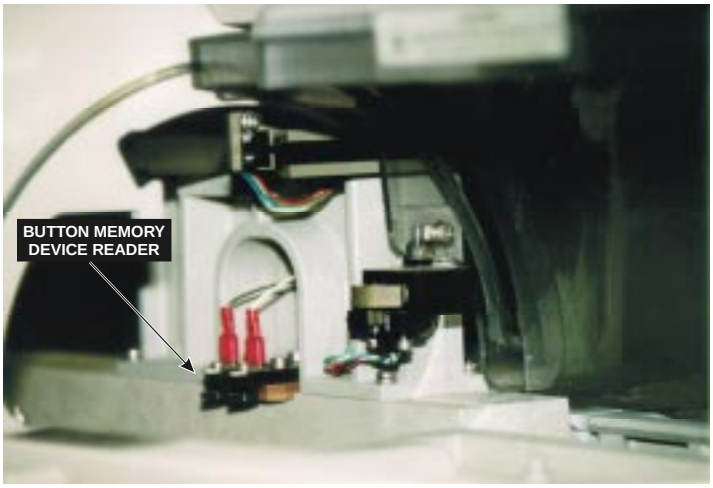


Figure 3-10 Button Memory Device Reader

Information is read from the cassette memory and transferred to the computer workstation (Figure 3-11). The information is used by the instrument to determine which operations are to be performed on the individual slots within each cassette. Once the data is transferred, the instrument marks the cassette memory as "read" in preparation for the next station cycle.

A security check of this information is provided by comparing the card information on the cassette memory to what is read by the laser bar code scanner.

Figure 3-11 Computer Work Station

Dispenser/Pipettor Station (Inoculum Preparation System)

The Dispenser/Pipettor Station automates the preparation of inoculums for susceptibility cards. This station also ensures that companion ID and susceptibility cards are processed from the same specimen, which provides a significant workflow advantage.

Figure 3-12 shows the location of the Dispenser/Pipettor Stations.

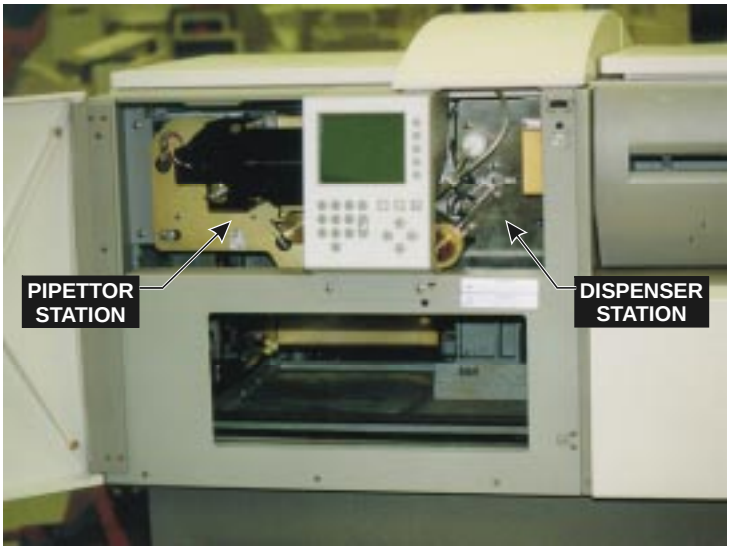


Figure 3-12 Dispenser/Pipettor Station

Dispenser System

The Dispenser System dispenses 2.33 ml – 2.63 ml of sterile saline solution into the test tube of each susceptibility card in a cassette. This system consists of a 1,000 ml bag of sterile saline, a "fixed volume" dispensing chamber (Dispensing Tube), two optical sensors, a mechanical control system, and volume tracking firmware to determine when the saline bag and dispensing assembly needs replacing. See Figure 3-13 for the location of the dispensing chamber.

Before the filling of the dispensing tube begins, the dispensing chamber will be in a idle position. When a susceptibility test is encountered, the dispensing tube will move to a fully counterclockwise position and the optical sensor flag will be sensed by the optical sensor (home position). An electrical solenoid inside the dispenser assembly opens a valve allowing saline from its bag to start filling the dispensing chamber. When the optical sensor located at the tip of the chamber detects the saline, the solenoid closes the valve and stops the flow of saline. With the chamber full and the saline flow stopped, the dispensing tube rotates over the susceptibility tube. With the dispensing tube positioned over the susceptibility tube, an air pump is activated. The air forces the saline from the chamber into the susceptibility tube at a controlled rate to prevent splashing. This process will be repeated for each susceptibility tube within a cassette. A filter is fitted in the air tubing from the air pump to prevent any particulate contamination.

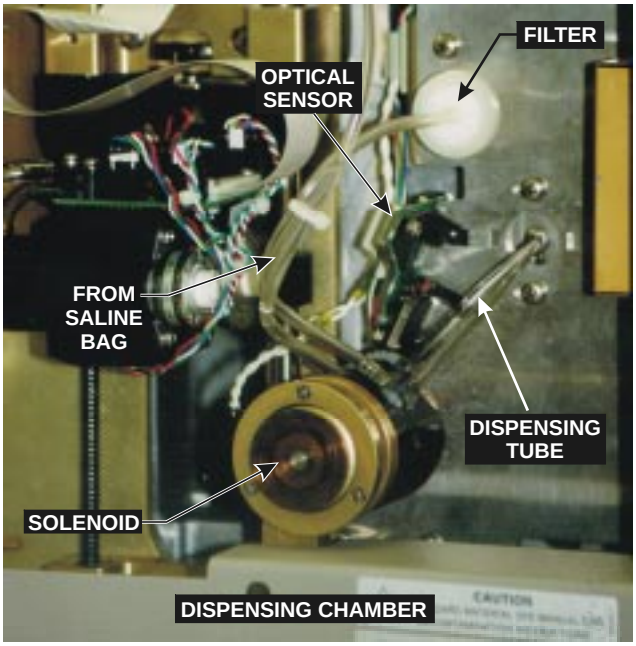


Figure 3-13 Dispensing Chamber

Both the dispensing tube assembly and the saline bag are disposable. The operator is required to replace the saline bag and the dispensing tube within 330 cycles or 30 days. The firmware will prompt the operator when the bag is approaching the empty level or approaching the expiration date.

See Figure 3-14 for the location of the Sterile Saline Bag.

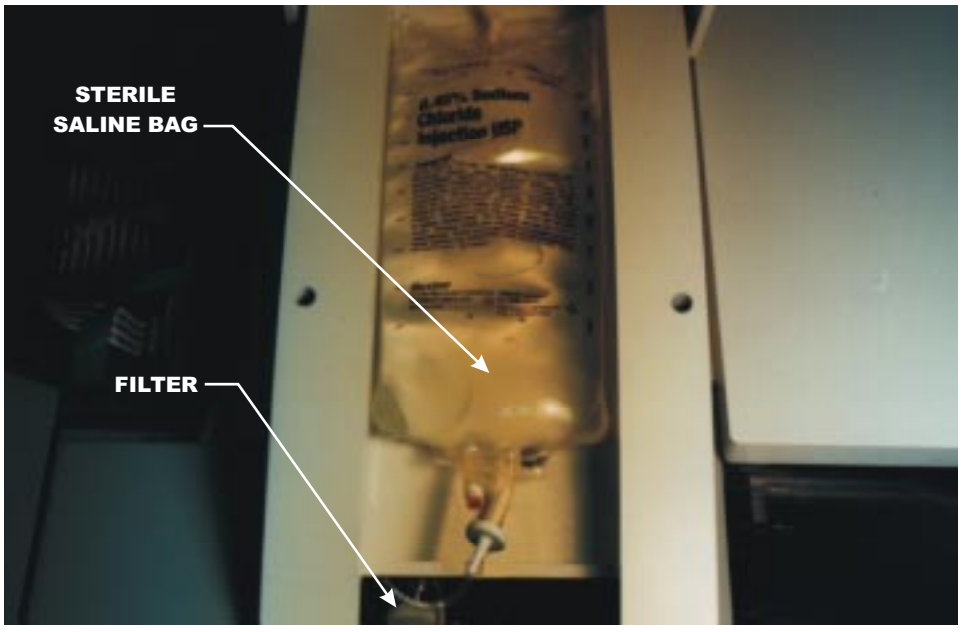


Figure 3-14 Sterile Saline Bag

Pipettor System

The Pipettor System transfers a volume of fluid (bacterial suspension) which is predetermined from the bar code, from the sample tube to the adjacent susceptibility tube. The system includes a drum (for disposable pipette tips), disposable pipette tips, and a pipettor pump assembly to deliver the disposable pipette tips to the tubes. See Figure 3-15 for the location and picture of the disposable pipette tips and drum.

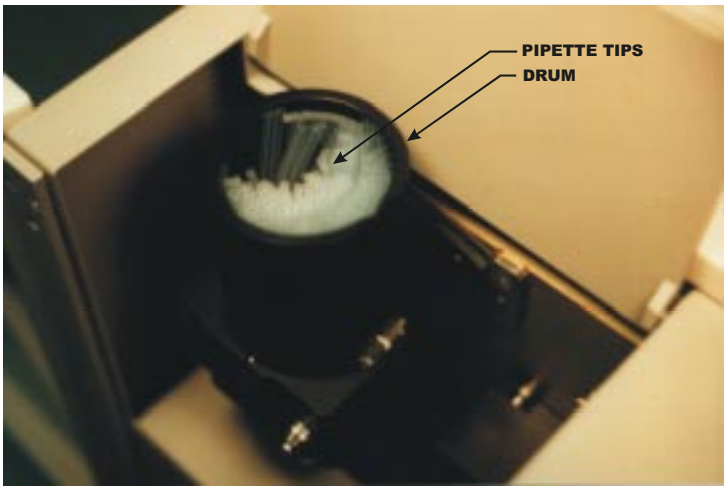


Figure 3-15 Disposable Pipette Tips and Drum

Within the Pipettor System the drum internally rotates until a disposable pipette tip is in position for the displacement pump. The pipettor pump assembly extends a hollow tapered pin into the drum, inserting the tapered pin into the disposable pipette tip. A vacuum transducer senses vacuum to verify that a tip is properly attached and then withdraws the pipette tip from the drum.

Figure 3-16 shows the Pipettor Pump Assembly.

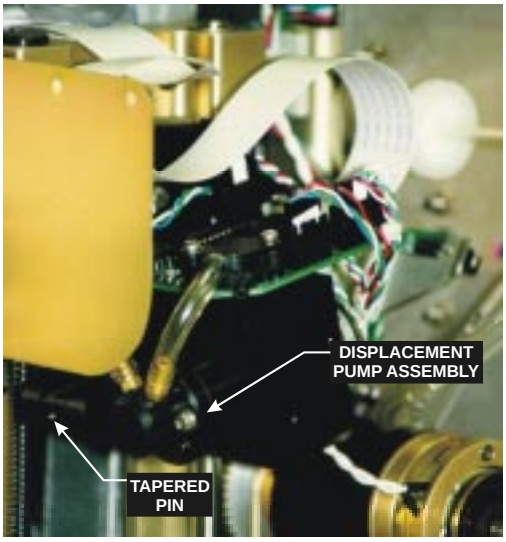


Figure 3-16 Pipettor Pump Assembly

The Transport System positions an identification sample tube beneath the Pipettor System. The pump assembly rotates so that the pipette tip is over the ID suspension test tube. The pipette tip is lowered into the suspension. The displacement pump draws the preprogrammed amount of suspension from the tube. The displacement pump assembly raises the pipette tip out of the tube.

The Transport System moves the cassette, placing the adjacent susceptibility sample tube under the pipette tip. The pipette tip is lowered into the test tube and the pump dispenses the suspension into the tube where it mixes with the saline (previously dispensed by the Dispenser System). The vacuum transducer will verify that the fluid transfer has been properly performed. A volume of air is then slowly bubbled through the tip to mix the inoculum.

Finally, the contaminated pipette tip is released by the pipettor pump assembly and left in the same sample tube for disposal.

The user loads up to 350 pipette tips into the drum. Firmware will prompt the operator when the drum is approaching the empty level or the expiration date of 30 days.

Vacuum Station

The Vacuum Station fills the wells of the card with an inoculum using vacuum displacement. The Transport System places a cassette and boat under the vacuum chamber. The vacuum chamber lowers onto the boat forming the lower half of the vacuum chamber. Figure 3-17 shows the vacuum chamber.

The Vacuum Station uses a vacuum chamber and pump. The rate of change of the vacuum is regulated by a pneumatic servo feedback system under microprocessor control.

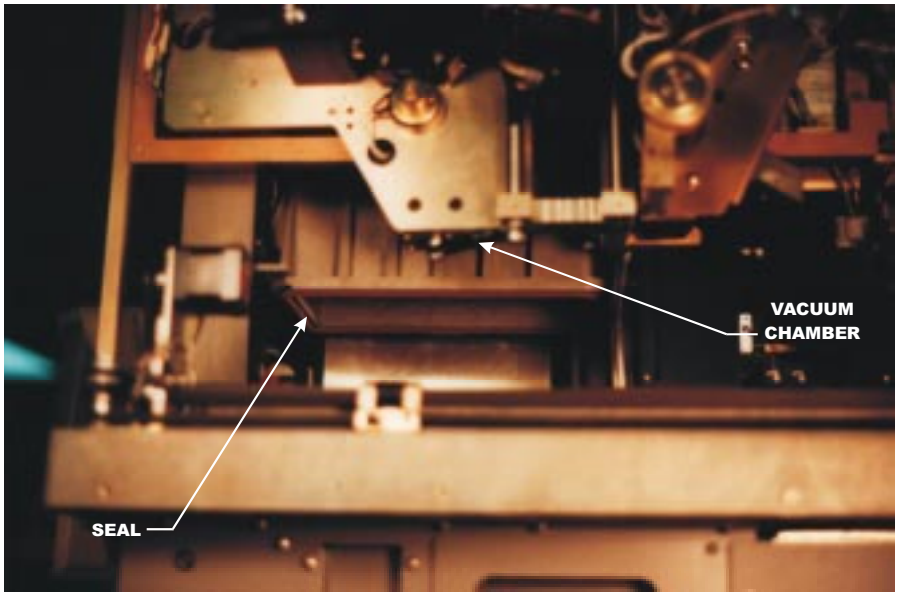


Figure 3-17 Vacuum Chamber and Seal

Figure 3-18 Vacuum Chamber Vacuum Pump

When the boat carrying a cassette reaches the vacuum station, the top of the vacuum chamber is lowered onto the boat surface. The seal on the vacuum chamber top presses against the boat surface sealing the vacuum chamber. The vacuum pump (Figure 3-18) starts drawing, or evacuating, the air from, the vacuum chamber. The air escapes from the card channels and wells via the transfer tubes and bubble up through the suspension. The channels and wells inside of each card are now in a vacuum.

After a short period, the vacuum is slowly released in the vacuum chamber. The increasing air pressure inside the chamber forces the suspension in each test tube through the transfer tube and into the channels and wells of the card.

Once the cards are filled, the vacuum chamber raises and the Transport System moves the boat cassette carrier to the next station.

Card Sealer Station

The Card Sealer Station completes the functions inside the ***VITEK•2®*** that prepare the test cards for incubation and reading. Before a test card can be incubated and read, the wells and channels inside the card must be sealed off from the outside environment. This is accomplished by heat-sealing the transfer tube that delivered inoculum to the card from its test tube.

As the boat and cassette move through this station, a heated nichrome wire comes in contact with each transfer tube. The plastic tube melts, causing the majority of it to separate from the card and drop into the test tube. The portion that remains in the card is sealed by the melting plastic. The heat sealed stub left from the transfer tube is 1 - 2.5 mm long.

Figure 3-19 shows the card sealer station.

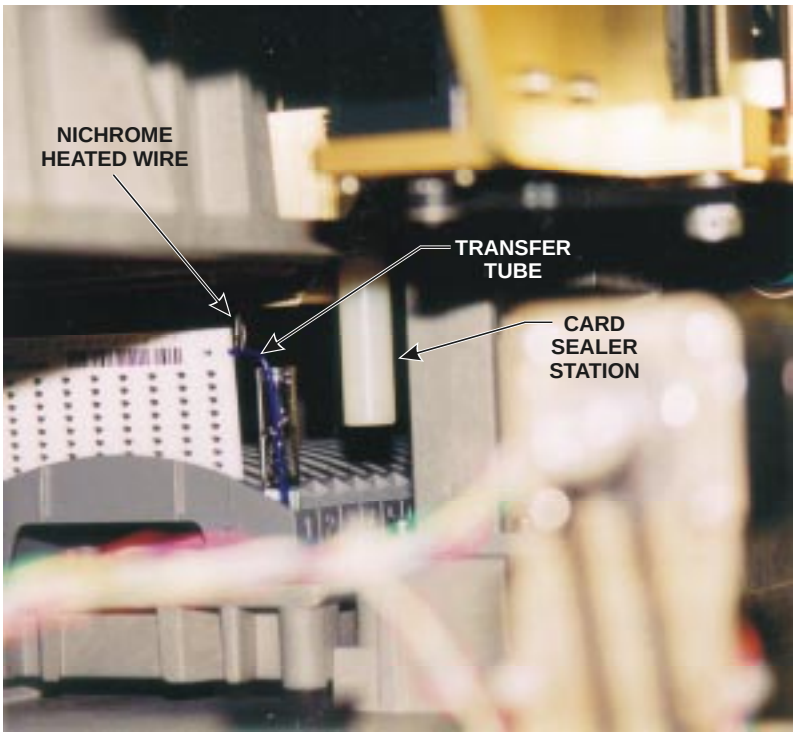


Figure 3-19 Card Sealer Station

Autoloader & Reader/Incubator Station(s)

After the cards have been sealed, the boat and cassette will move to the Incubator Loading Station. The components of this station are the carousel incubator and the optics system. (See Figure 3-20.) The ***VITEK•2®*-60** includes one Autoloader & Reader/Incubator Station. The ***VITEK•2®*-120** consists of two Autoloader & Reader/Incubator Stations (Section A & B).

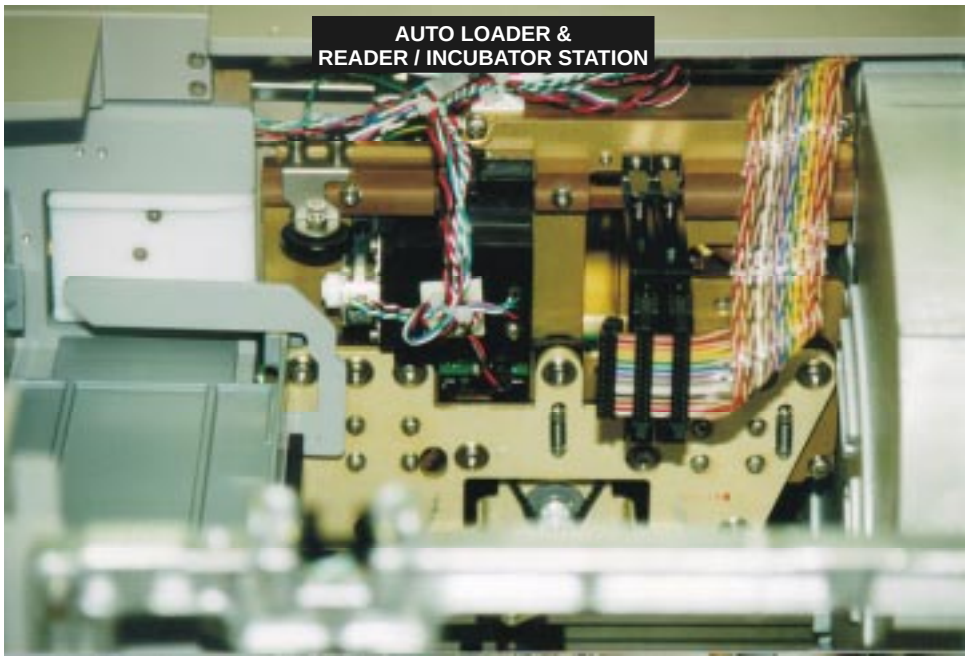


Figure 3-20 Autoloader & Reader/Incubator Station

When a boat and cassette reach the card loading station, the cards will be transferred from the cassette into slots by the autoloader in to a 60-position carousel. Here they are incubated at a temperature of 35.5° ± 1° C (95.9ºF ± 1.8ºF).

NOTE: The carousel is divided into four sections so that it can be easily removed for periodic cleaning.

Figure 3-21 shows the Autoloader.

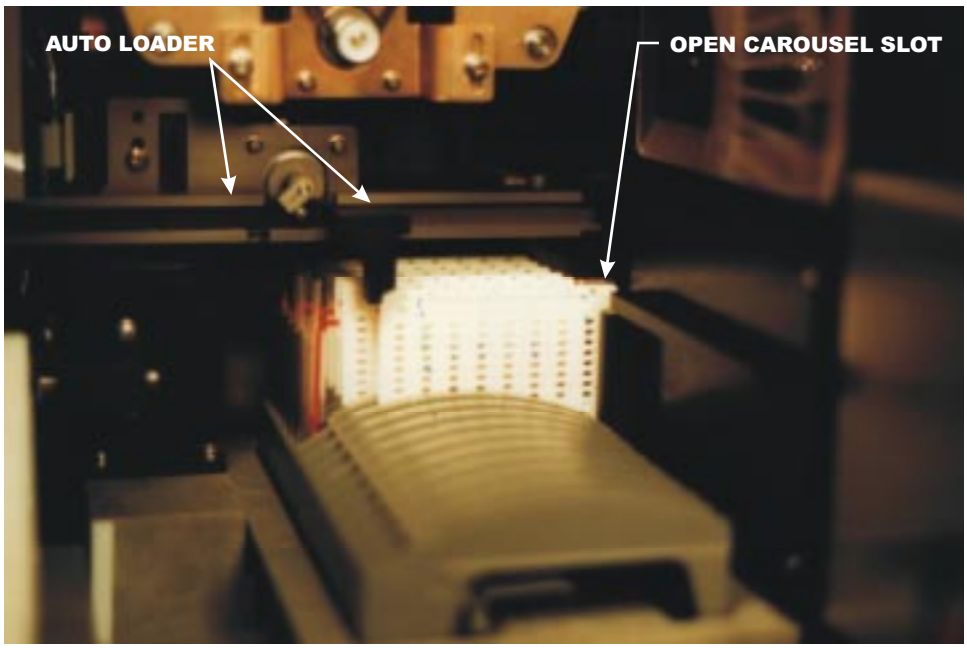


Figure 3-21 Carousel Loading Station

As the carousel rotates, each card moves into the reading position every fifteen minutes. A card ejector pushes the card onto a drive belt where it is moved through the reader optic station.

After the reading cycle is complete, the card returns to its slot in the carousel, where it continues to be incubated until its next read cycle.

Figure 3-22 shows the Reader Optics Station drive belt. Figure 3-23 shows the Reader Card Ejector.

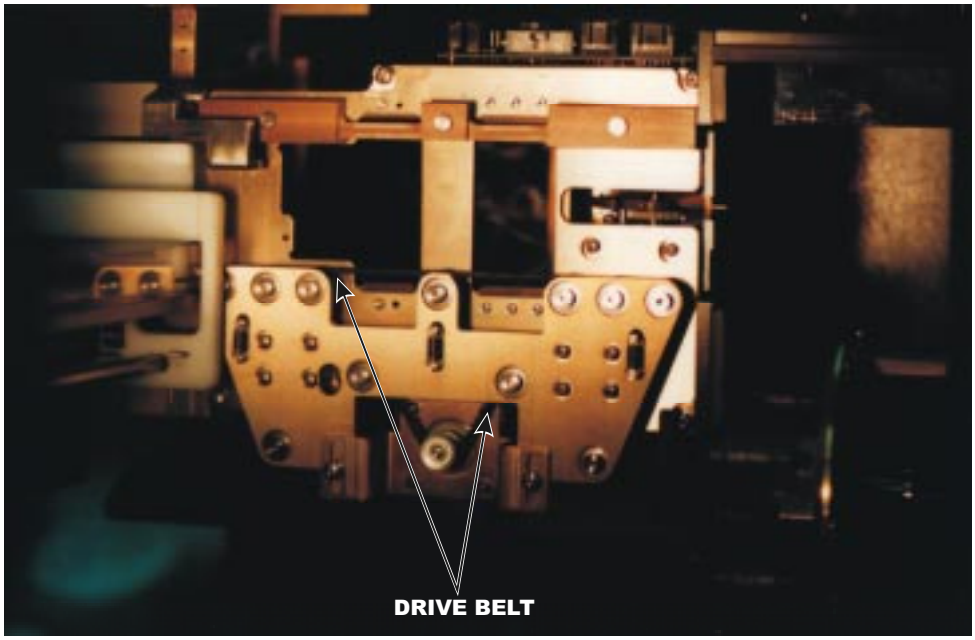


Figure 3-22 Reader Optics Station Drive Belt

Figure 3-23 Reader Card Ejector (back cover removed)

Incubator Heater Assembly

The carousel contains a heater and two circulating fans used to incubate the test cards. The temperature is monitored and controlled by two remote precision thermistors monitored by an A/D converter. These inputs are compared to voltages produced by high precision resistors. This will enable the temperature at the card to be held at an average temperature of 35.5 ± 1°C (95.9ºF ± 1.8ºF).

Figure 3-24 shows the Heater Assembly.

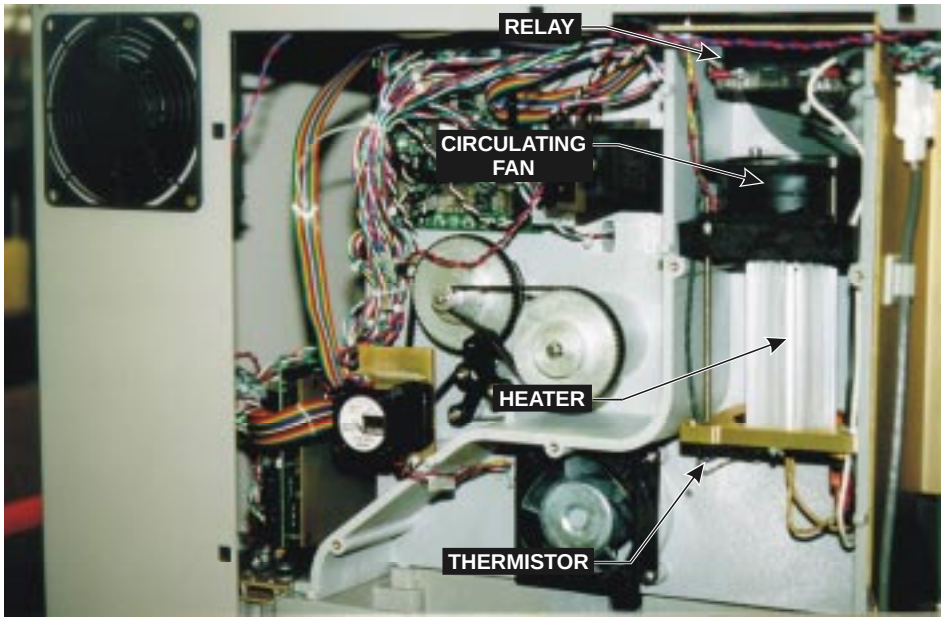


Figure 3-24 Heater Assembly (in molded incubator)

Reader System

***VITEK•2®*-60** consists of one reader system made up of a card drive belt system, a fluorescence optical system, and two transmittance optical systems. ***VITEK•2®*-120** contains two reader systems. Reader Section A, which includes the same components as the 60 capacity instrument and Reader Section B, which only includes one transmittance optical system (660 nM). (There will be an upgrade option allowing installation of a second fluorescence and a 568 nM transmittance to the 120 capacity instrument.) The optical systems are modular with each module independently controlled by a microprocessor. This area is accessible to the user for maintenance functions. (See Figure 3-25.)

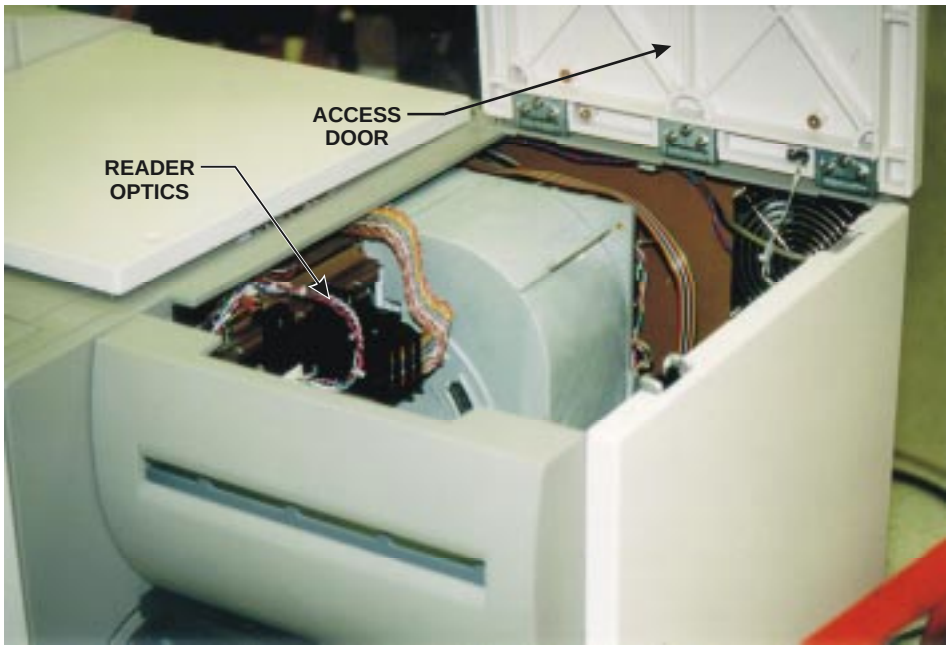


Figure 3-25 Reader System Accessibility

The ***VITEK•2®*** performs its identification and susceptibility analyses by continually monitoring the growth of organisms inside the wells of the test cards. Two different types of optics perform this function, fluorescence optics and transmittance optics.

Fluorescence Optics

The fluorescence optics detect the growth of organisms indirectly. It detects a chemical byproduct of their growth rather than the organisms themselves. This chemical, called a fluorophore, absorbs light at a wavelength of 365 nM and immediately re-emits the light at a different wavelength, 445 nM.

A xenon flash tube and optical filters are used to create the specific wavelength of light and a fluorescence detector captures light re-emitted by the fluorophore. The biochemical system in these wells is designed to produce this substance in direct proportion to the growth of the organisms. The amount of re-emitted light produced, therefore, provides an excellent growth indicator.

The fluorescence optics calibrate to a known external 4-MU bioMérieux prepared standard and periodically self-check and adjust calibration against a internal phosophorescent reference.

Figure 3-26 shows an illustrated cross sectional view of the fluorescence optics.

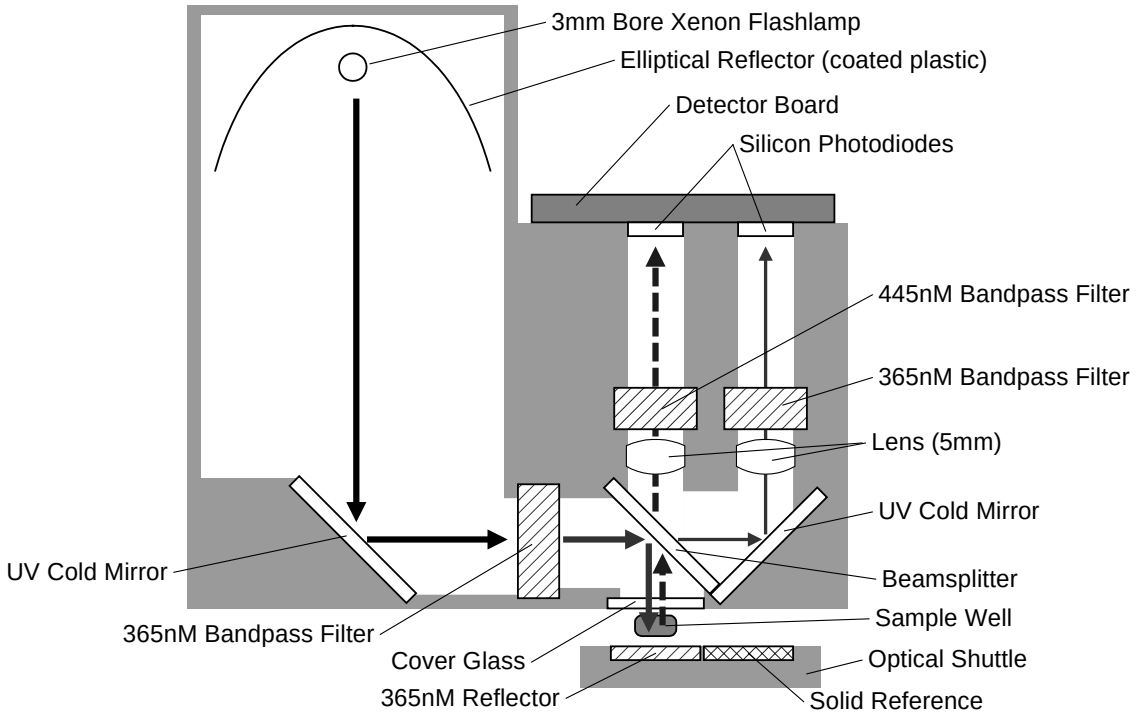


Figure 3-26 Fluorescence Optics Cross Section

Transmittance Optics

The transmittance optics use visible light to directly measure organism growth. These optics are based on an initial light reading of a well before significant growth has begun. Periodic light transmittance samplings of the same well measure organism growth by how much light is *prevented* from going through the well.

The optics uses light emitting diodes (LEDs) that produce light at 660 and 568 nM and silicon photodetectors to capture the transmitted light. The system is self-calibrating to 100% transmission through air.

Figure 3-27 shows an illustrated cross sectional view of the transmittance optics.

☞ **NOTE:** The optics should be cleaned periodically.

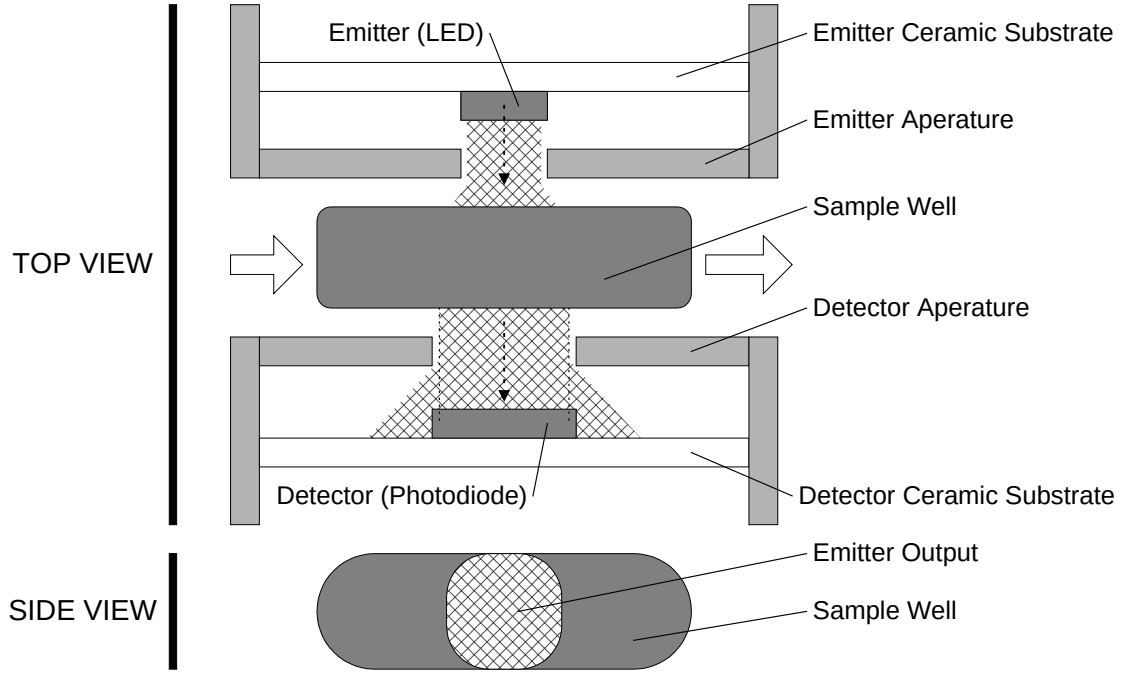


Figure 3-27 Transmittance Optics Cross Section

Waste Collection Station(s)

Once testing a card is complete the card will be removed automatically from the carousel by the card ejector, it will advance through the reader system and then is deposited into a waste container. Here the stacker push plate pushes the card out of the way so the next card to complete can be ejected into the collection tray. These cards are collected at the Waste Collection Station for removal from the ***VITEK•2®*** and disposed of. (The ***VITEK•2®*-120** includes two Waste Collection Stations.)

The system will send a message to the user interface panel when the station container approaches the full level. The station container can then be removed from the instrument and emptied. Each Waste Collection Station will collect and hold up to 60 cards for disposal.

Access to the Waste Collection Station is made by a door on the front of the ***VITEK•2®*** instrument. Figure 3-28 shows the waste collection station, waste collection tray, and test cards.

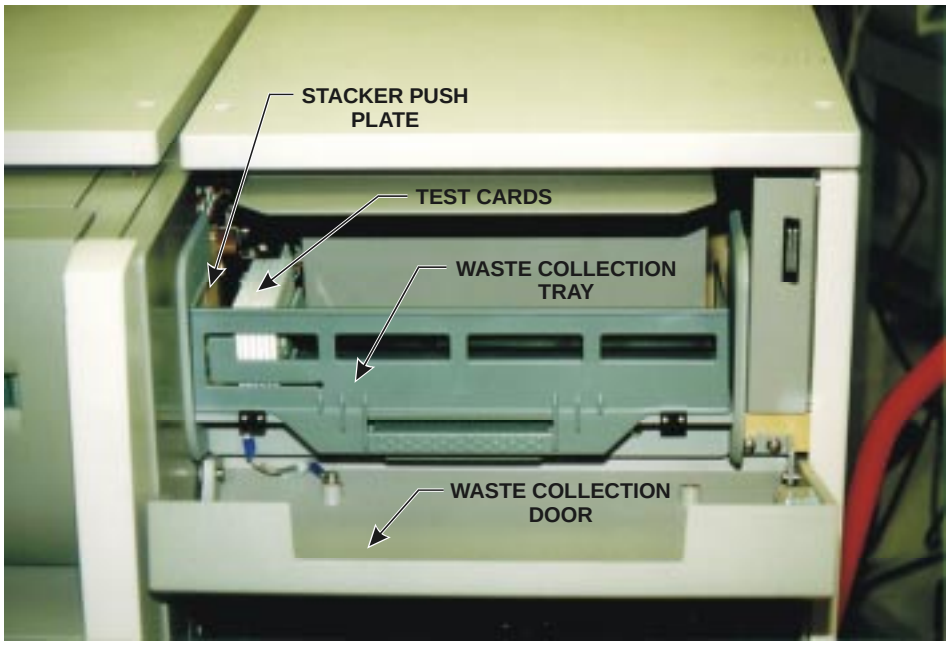


Figure 3-28 Waste Collection Station

Figure 3-29 shows a card being ejected into the waste collection tray.

You can eject cards by command, or automatically by setting an option in the System Configuration window of the workstation.

WARNING! Ejected cards cannot be reinserted into the ***VITEK•2®***. Make sure that all card processing has been completed before ejecting a card.

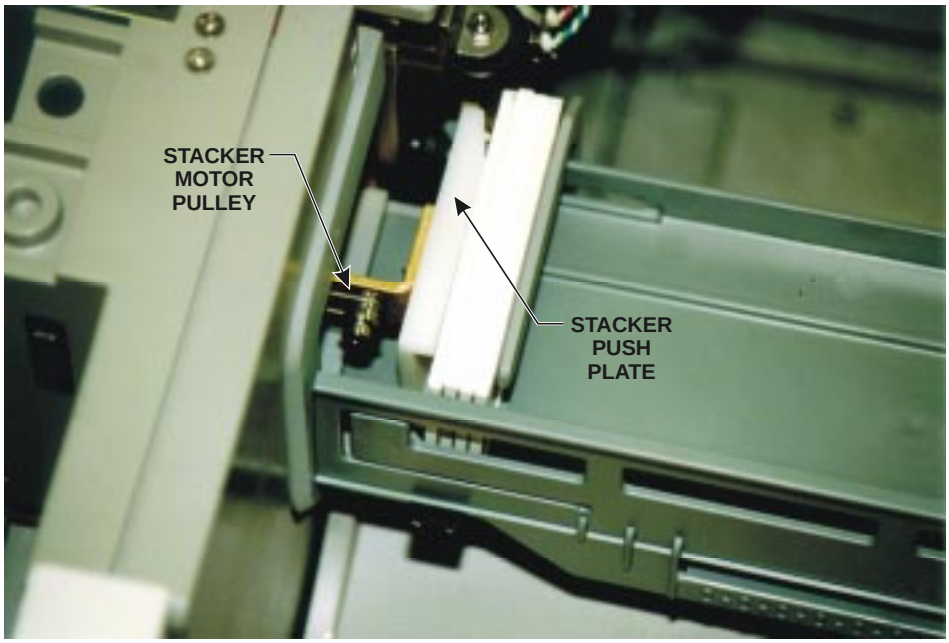


Figure 3-29 Card Ejection

NOTE: The waste collection door should remain closed when cards are not being removed from the station.

NOTE: The Waste Collection Station should be emptied whenever a new cassette is loaded into the instrument.

NOTE: Once cards are removed from the Waste Collection Station, they should never be reinserted. (This could cause jams.)

Chapter Four: **System Components**

Chapter Four is designed to familiarize the user with the five major systems of the ***VITEK•2***® instrument. Information from the previous chapter explained the product flow through the various stations of the instrument. In this chapter, we provide more detailed descriptions of the individual component parts of each system and their functions.

The ***VITEK•2***®**-60** and the ***VITEK•2***®**-120** Integrated Instruments are made up of the following systems:

- Interface System
- Card Transport System
- Card Preparation System
- Reader / Incubator Processing System(s)
- System Electronics

VITEK•2® Interface System

The ***VITEK•2***® Interface System is made up of the following primary internal components:

- User Interface Keypad and Screen
- Uninterruptable Power Source (UPS)
- Workstation Computer

User Interface Keypad and Screen

The keypad and screen are located on the front of the instrument and provides the user with local access and monitoring of the instrument operation. The keypad and screen are mounted together on an easily removable mounting plate for servicing. An audible alarm feature installed in the instrument and a flashing display is used for alerting the user in the event of instrument alarm conditions.

The keypad is composed of a set of numeric digit keys and several function keys for the user to communicate commands to the instrument. The screen is a back lit Liquid Crystal Display (LCD). Five function buttons are located beside the LCD. The screen provides the visual information during user intervention when selecting the menu options.

The keypad and screen allows the user functional support of the following:

- Local instrument operation and system status
- Consumables loading
- Diagnostics and maintenance operations
- Available card slots
- Incubator temperature
- Error messages
- Multi-language support

Figure 4-1 shows the keypad and screen along with the location of the keys, LCD screen, and buttons.

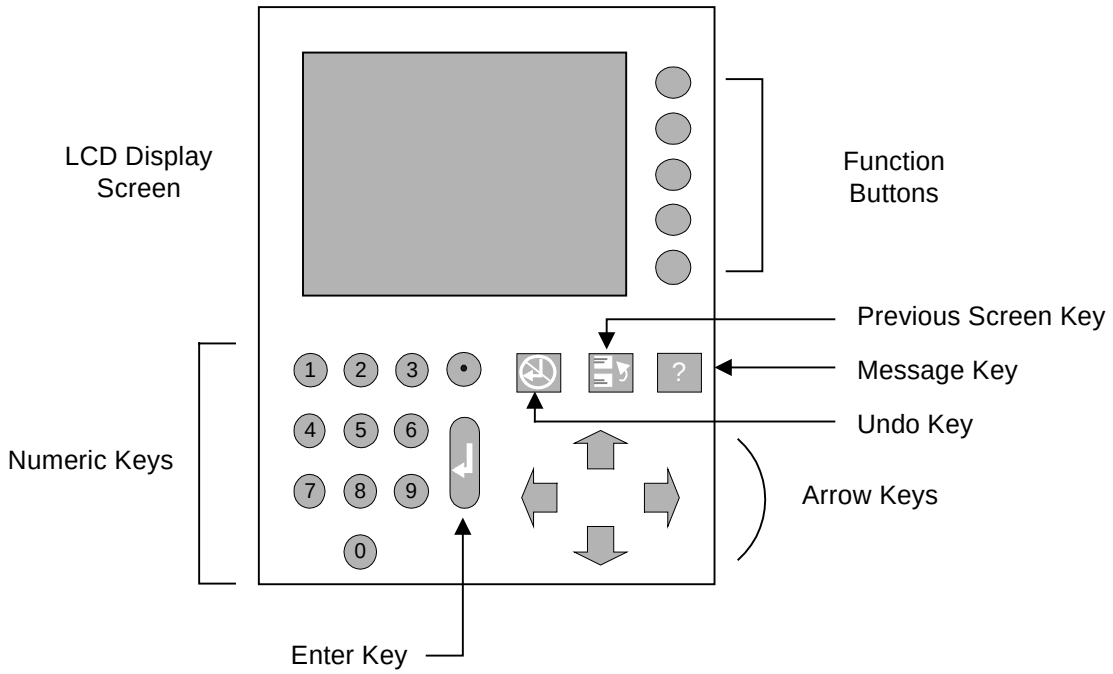


Figure 4-1 Keypad and Screen

There are three ways the Status screen can be viewed. When the instrument is turned on, when the user interface is in a menu screen and is unattended for more than three minutes or by pressing the previous screen key of the user interface from the main menu.

The Status field can display following conditions:

OK Subsystem in the instrument are working normally.

Warming Indicating the incubator has not reached its operating temperature.

Messages Indicating that there is an error message in the queue that needs to be viewed and resolved. Pressing the message button on the user interface will display the first messages. Pressing the down arrow will display any other message that may exist. All messages must be viewed or the message status will remain.

Errors Indicating that the message has been viewed, but has not been resolved. This status can be cleared only by resolving the condition that generated the original message.

Cleaning Indicating that boats and/or carousel quadrants have been removed for cleaning.

Figure 4-2 shows the ***VITEK•2***® instrument Status screen.

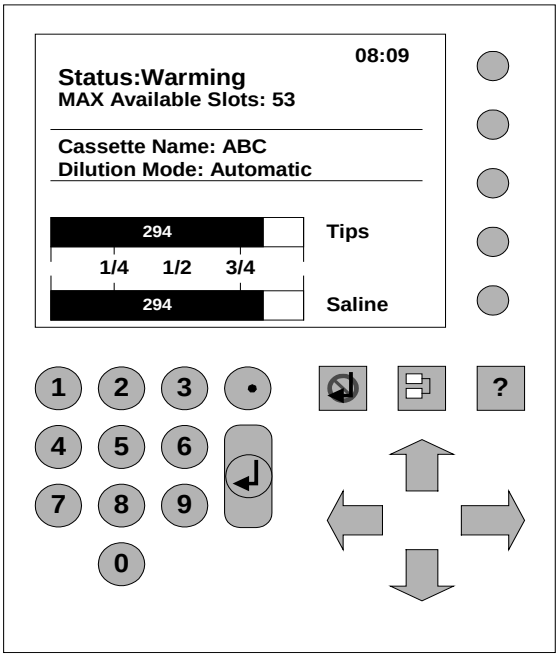


Figure 4-2 ***VITEK•2***® Instrument Status Screen

If a Halted screen is displayed instead of the Status screen, this indicates that there is a movement error condition in either the transport or reader (carousel) and that portion of the instrument has stopped processing. The Halted screen will display which section has the halted condition (transport or reader), how many minutes the halted condition has existed, how many messages are in the message queue, and it will display a GO button to be pressed after the problem is corrected. (The messages need to be viewed and the condition needs to be resolved before the GO is pressed.)

Figure 4-3 shows the instrument Halted screen.

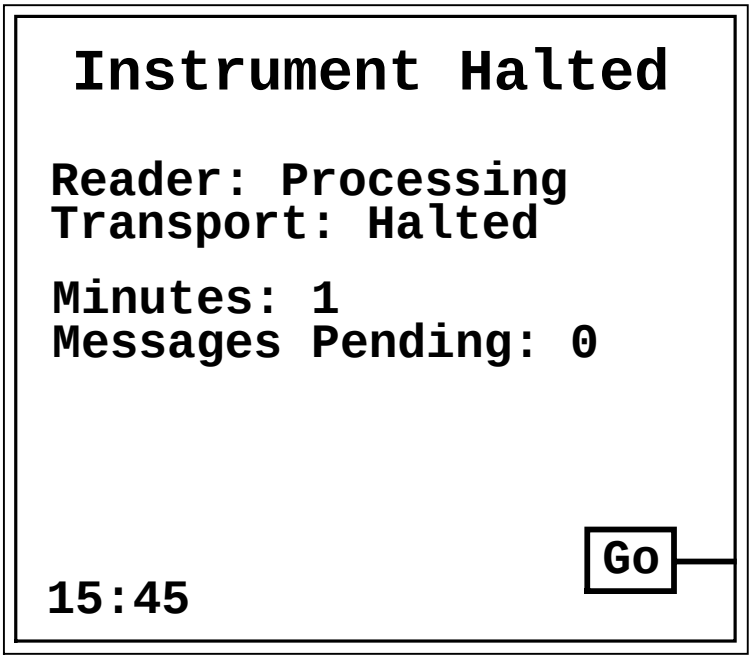


Figure 4-3 Instrument Halted Screen

All of the functions used on the ***VITEK•2®*** instrument are available through the menu system. The system is composed of a Main Menu and a set of five submenus, as shown in Figure 4-4.

User Interface Flow Diagram

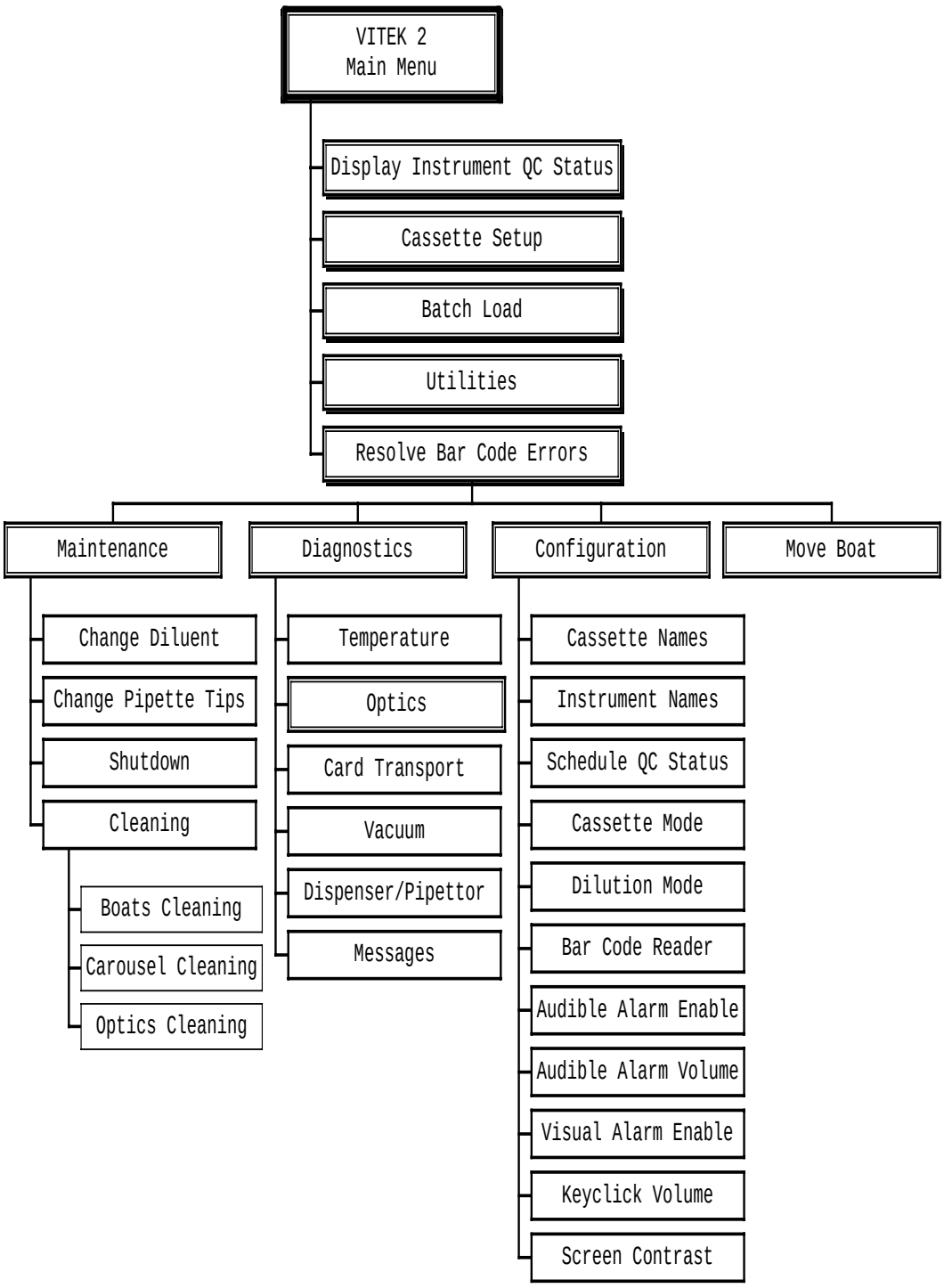


Figure 4-4 User Interface Flow Diagram

Uninterruptable Power Source (UPS)

The UPS is connected to a 9 pin communications port located on the left rear corner of the instrument via a RS232 cable. See Figure 4-5 for the location of the port connection.

In the event of a power failure, the UPS will signal the ***VITEK•2®*** instrument. If the power failure lasts longer than 5 seconds, the instrument will go into a power failure mode. At this point no "new" cassettes can be loaded into the instrument. If there are previously loaded cassettes in the transports, it will continue to process and load the cards for up to 20 minutes or when the UPS sends a battery low. All of the cards in the carousel will continue to be read until the UPS battery is exhausted. If cards remain in the transport after 20 minutes or a battery low, the transports will pause and the remaining cards should be considered terminated. After power is restored the cassettes must be retrieved by using the move boat command.

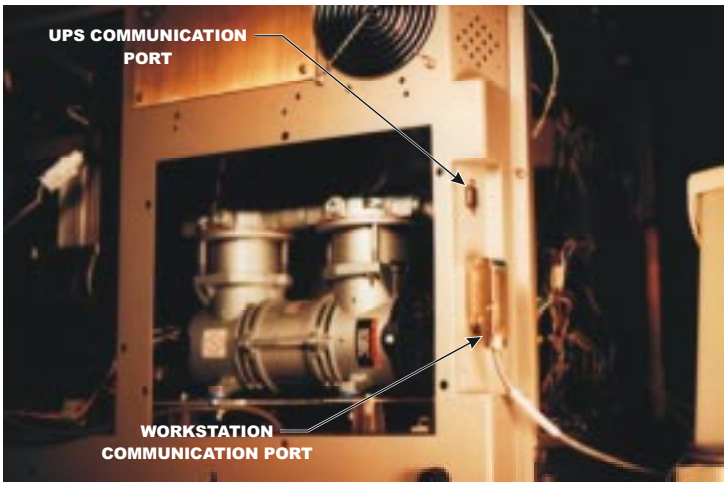


Figure 4-5 UPS and Workstation Computer Communication Port Locations

Work Station Computer

The Work Station computer is a central diagnostic station. It is connected to a 25 pin communication port located on the left rear corner of the instrument via an RS232 cable. (See Figure 4-5.) Under normal conditions, the instrument will send system status, test card data, and operational data to the workstation. The Work Station serves as the instrument supervisory control, test data storage, system status information, and data entry for the instrument. (Should the computer fail, the ***VITEK•2®*** instrument is capable of sequentially buffering 2700 card hours before the oldest data begins dropping off.)

Figure 4-6 shows the workstation computer.

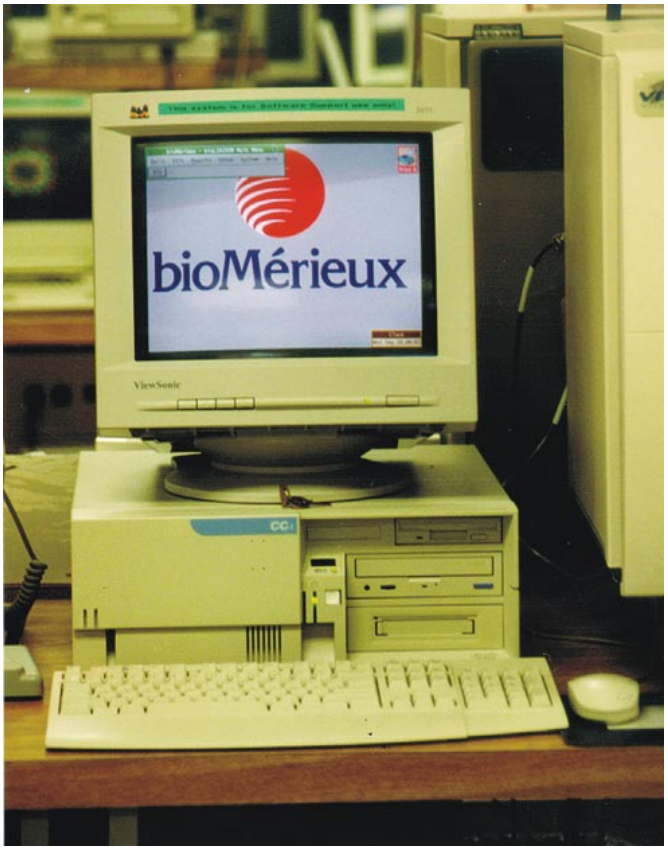


Figure 4-6 Workstation Computer

Card Transport System

The ***VITEK•2®*** Card Transport System is made up of the following primary internal components:

- Cassettes and Boats
- Cassette Load/Unload Station
- Transport Assemblies

Cassettes and Boats

The cassette is the main component of the transport system. The cassettes are pre-loaded external to the instrument with tubes of patient isolates, tubes for susceptibility dilution, and test cards.

The back portion of the cassette holds a maximum of 15 test cards in specially fitted slots. The front portion of the cassette has 15 wells for the card's inoculum test tubes. The cassette is placed into a boat for transport through the instrument. The special shape of the cassette matches the shape of the boat well, which ensures that the cassette is properly loaded.

Each cassette can be fitted with a button memory chip. The memory chip stores each card's test information from the Smart Carrier System (SCS) and is read by the instrument. Each memory chip is easily installed and removed by the pressure latch lever holding the chip in its carrier. The button memory chip and carrier are removed before cassette cleaning and are reusable after being read by the button memory reader. The button memory reader is discussed later in this chapter.

The boat carries the cassettes throughout the various processing stations inside the instrument. The instrument can carry up to four boats which normally remain in the system but are removable for cleaning.

The top surface of the boat forms a specially shaped cavity allowing one way positioning of the cassette into the boat. The top surface also forms the bottom of the vacuum chamber (discussed later in this chapter). The boat cavity design will catch any spill from the loaded cassette. The boat rests on four low-friction feet to allow for easy movement in the instrument. The base around each boat is notched in several places for the transport paddles to catch and move the boat throughout the process stations of the instrument.

Figure 4-7 shows a loaded cassette and boat.

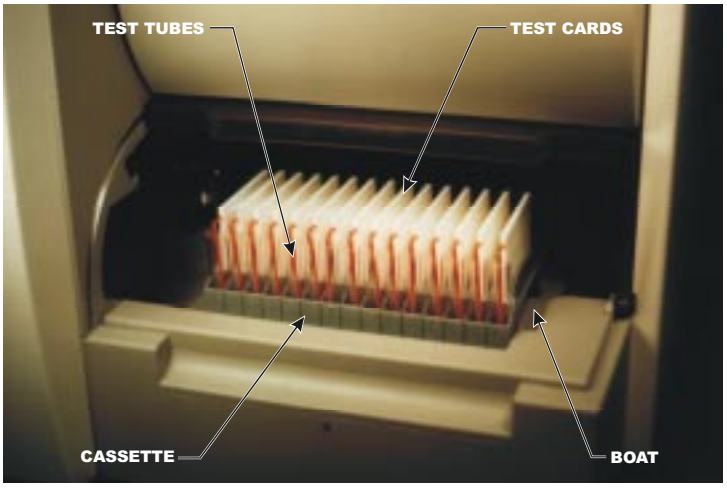


Figure 4-7 Loaded Cassette and Boat

Cassette Load/Unload Station

Cassettes are placed onto boats and removed from them at the cassette load/unload station. The station consists of a sliding cassette loading door, a green LED indicator light, a queuing cassette reflective sensor and a door locking mechanism.

Cassettes are loaded onto a boat through a open door at the load/unload station. A green LED below the station is illuminated when the instrument is ready to accept a cassette. When the cassette is loaded onto the boat, the queuing cassette reflective sensor detects the presence of the loaded cassette. The operator closes the cassette loading door, the door lock solenoid initiates and the green LED will go out. At this point, test card processing automatically initiates. (The cassette loading door remains locked whenever a boat is moving through the Load/Unload Station.) Table 4-1 shows the LED status light information.

Once the cards have been processed and loaded into the incubator, the boats return the cassettes containing processed patient isolate tubes to the Load/Unload Station for removal from the system. The cassette will be parked at the cassette loading door with the door unlocked and the operator notified by the "flashing" load/unload LED. The operator can then remove the cassette and dispose the processed test tubes. The boat will remain in place for the next cassette, or it will advance to make room for the next processed boat to come forward to the station.

Table 4-1 Load/Unload Station LED Status

LED STATUS	LOADING AND UNLOADING STATION STATUS
ON	The cassette loading door is unlocked. Cassettes can be loaded.
OFF	Cassette loading door is locked. At this time a boat is traveling through the load/unload station.
BLINKING	Boat with a cassette has arrived at the station. Cassette loading door can be opened to remove the cassette and dispose of the remaining waste. Closing the door after removing the cassette causes, the LED light to stop blinking.

Figure 4-8 shows the load/unload station along with the location of the LED indication light.

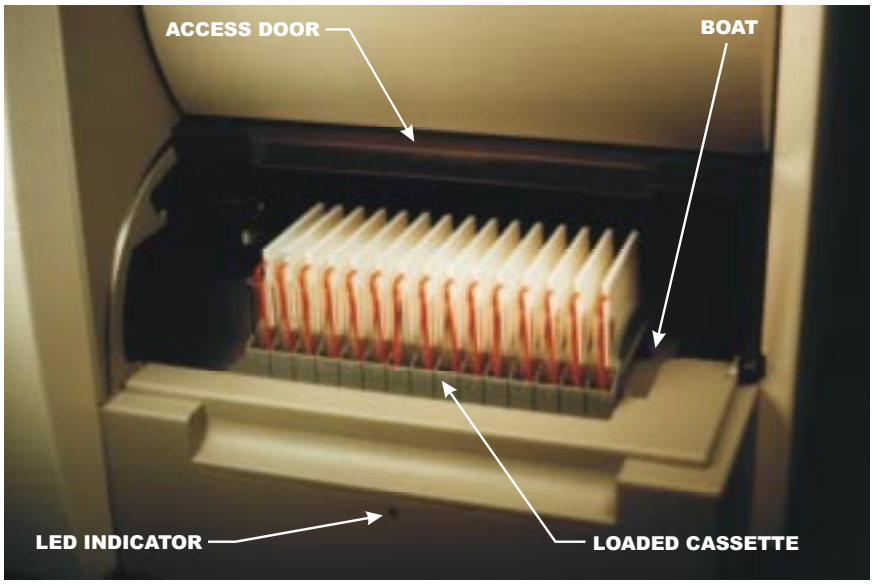


Figure 4-8 Loading and Unloading Station

Transport Assemblies

The transport assembly moves the boats by pulling them through each process station within the instrument. The transport assembly consists of four independently mounted transports inside the base of the instrument; front, back, left, and right. Each transport functions the same but is independently controlled. Various sensors tell the instrument where each boat is located and the status of the transport system.

Figure 4-9 and Figure 4-10 shows a transport assembly and components.

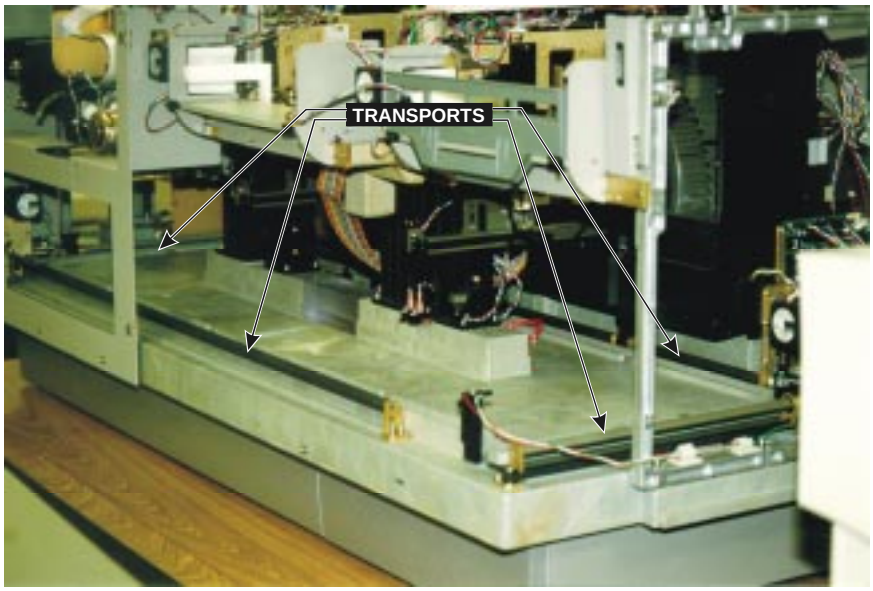


Figure 4-9 Transport Assembly

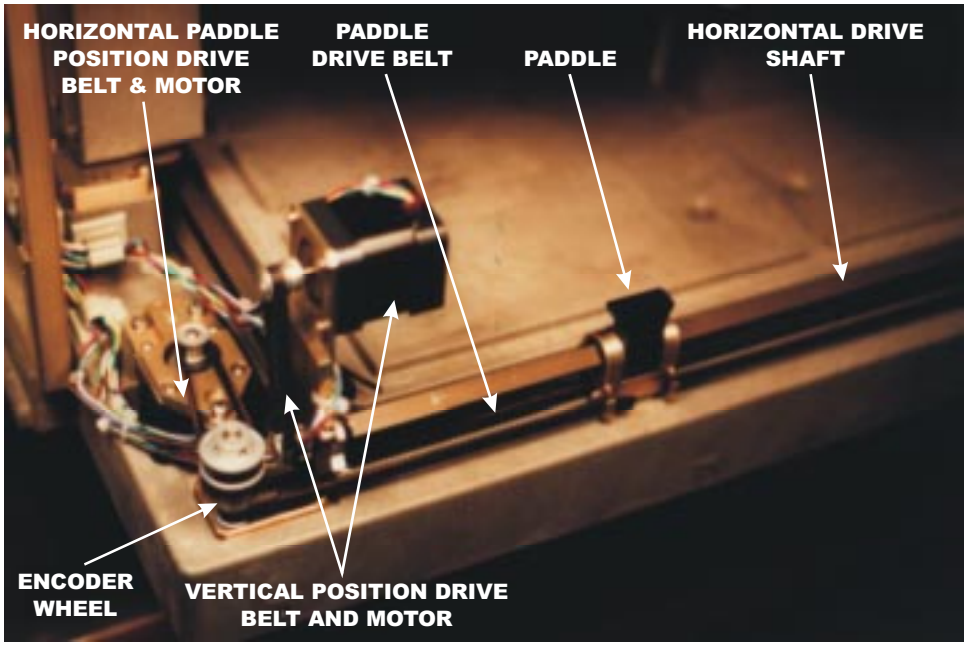


Figure 4-10 Transport Assembly and Motors

Each transport consists of a square horizontal drive shaft with a belt driven paddle that moves horizontally by a drive motor. A transport home switch sensor is attached to a vertical position plate. The paddle checks this sensor before hooking the next boat or in the event of a transport jam. This transport home switch assembly is the transports reference point for proper stepping and positioning.

The horizontal drive shaft also rotates, which causes the paddle to be in either an up or down position. When it is in the up position, it is either preparing to hook the next boat or it is in an idle state. When it is in the down position, the paddle is in a pocket of a boat and is ready for transport. Shaft rotation is accomplished by a separate drive motor and belt. A transport paddle switch sensor mounted to the vertical position plate detects the up/down rotation of the paddle.

An encoder is located on the front and back transports. It is a notched wheel between a transport encoder sensor . As the boat is pulled through the front and back transport, the rotation of the encoder is monitored. If there are any stalls on the transport, it is detected by the sensor and the instrument will respond appropriately.

There is a reflective boat sensor that monitors the presence and verifies removal of the boats during the boat cleaning process. It is mounted to the front/left corner of the basepan.

Card Preparation System

The ***VITEK•2***® card preparation system is made up of the following primary internal components:

- Cassette Scan Station
- Dispenser/Pipettor Station
- Vacuum Station
- Card Sealer Station

Cassette Scan Station

While passing through the cassette scan station, each test card is positioned in front of the bar code reader. A card separator holds each card in place, so the laser from the bar code reader can scan the bar code information of the test card.

Figure 4-11 shows the laser bar code scanner. Figure 4-12 shows the card separator.

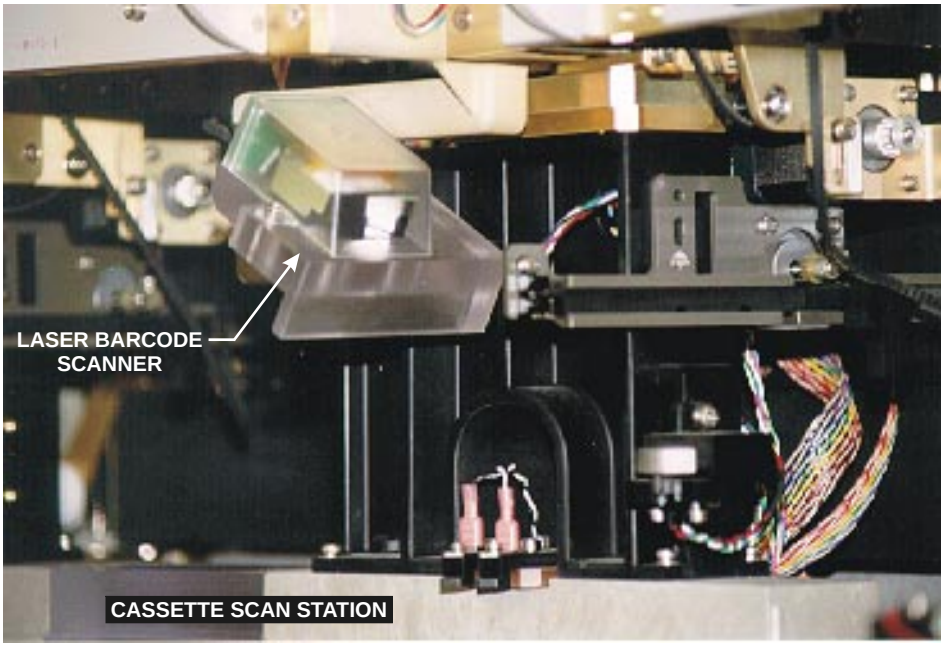


Figure 4-11 Laser Bar Code Scanner

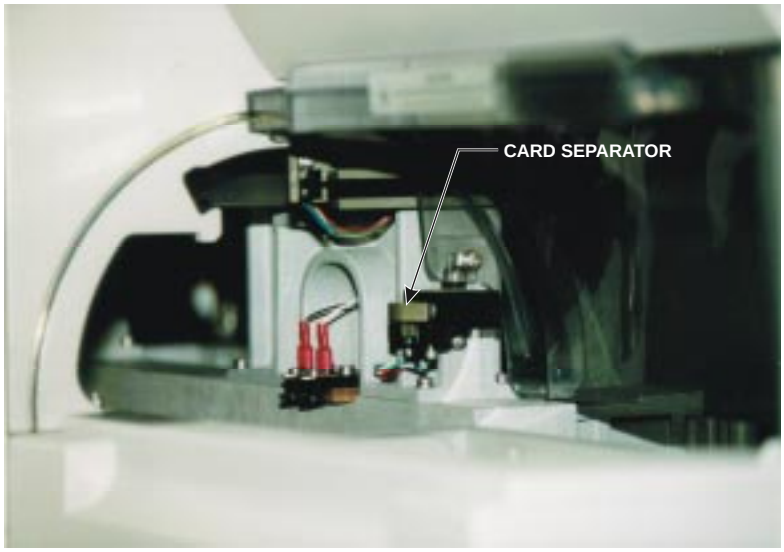


Figure 4-12 Card Separator

Card Separator

Each cassette test card makes contact with the plunger of the card separator as the cassette is transported through the station. The cards push against the card separator's spring loaded, lobe shaped plunger causing the card to lay back in the card slot of the cassette. The lobed design and the card movement pushes the plunger into the path of the card separator sensor. The blocked condition of the sensor tells the instrument that a card is in that particular cassette slot. The separator holds the card at an angle for the scanner to read the bar code information on the test card. (The location of each card in the cassette is determined by the card separator in conjunction with the bar code reader.)

Figure 4-13 shows the card separator with the test card in position to be scanned.

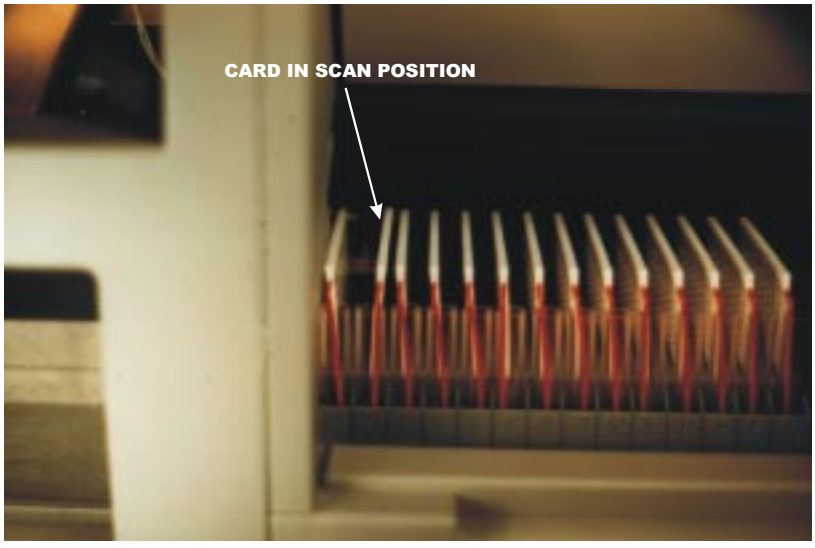


Figure 4-13 Card Separator Holding Card In Scan Position

Laser Bar Code Scanner

The laser bar code scanner projects a horizontal beam of laser light across the bar code label on the test card, and reads the encoded information on the bar code label. The laser will read bar code information such as card type, lot number, expiration date, and a unique sequence number. From this information, the proper dilution volume and optics method will be determined for that card.

If the instrument is set up in SCS mode, the scanned information is also compared to the button memory reader information. This is to ensure that the scanned test card is loaded in the correct slot as indicated by the button memory.

Figure 4-14 shows an illustration of the laser bar code scanner as it scans a test card.

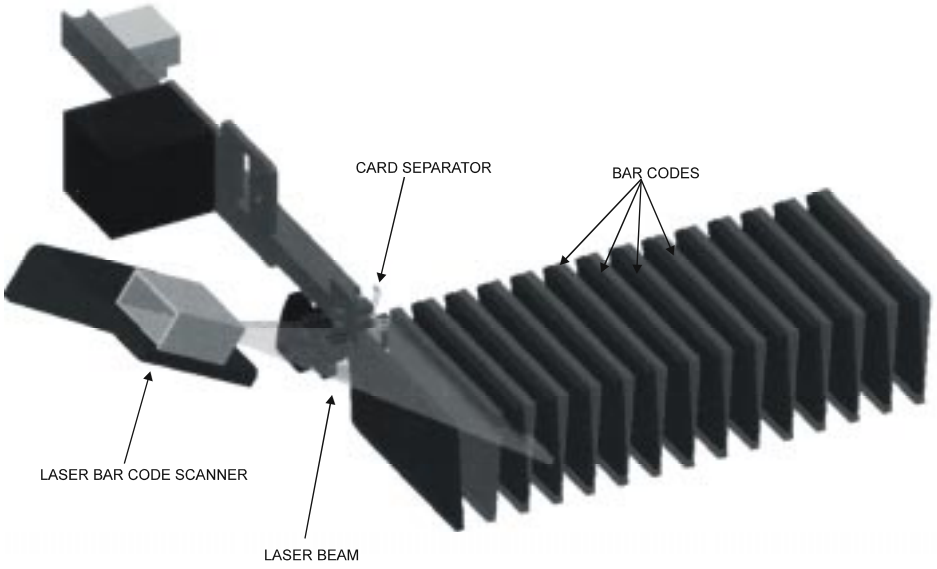


Figure 4-14 Laser Bar Code Scanner Scanning Test Card

Button Memory Reader

The button memory reader is a device that the instrument uses to read the test card information stored by the Smart Carrier Station (SCS) on the button memory chip of the cassette. This non-volatile memory device contains the patient, test, and carrier specific information for the system. The button memory reader is located at the cassette scan station.

Figure 4-15 shows the button memory reader in the instrument.

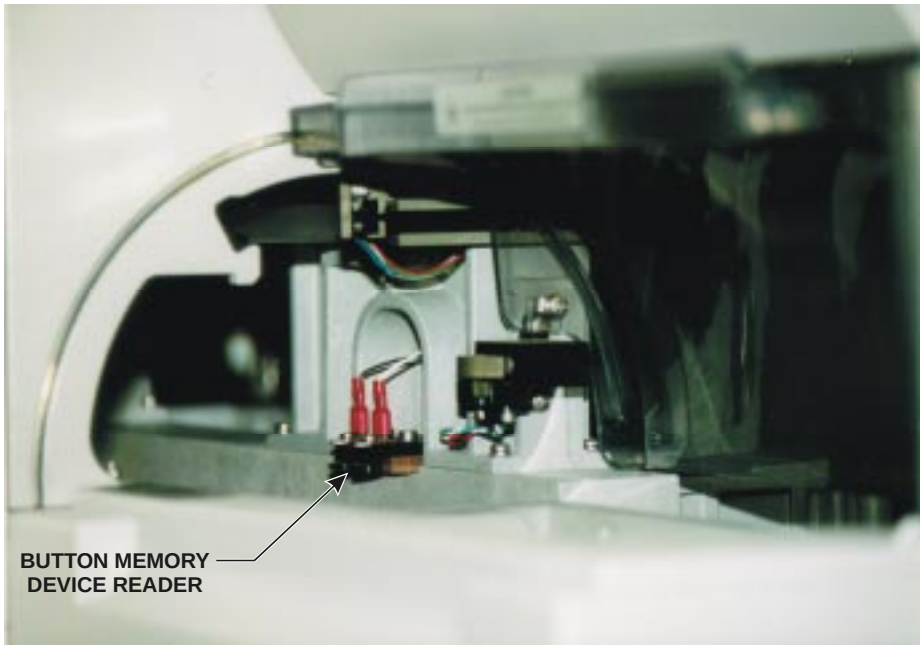


Figure 4-15 Button Memory Reader Contacts

The button memory reader has two spring loaded contacts that make contact with the arriving cassette button memory chip contacts. When the ***VITEK•2®*** is set-up in the Smart Carrier Cassette Mode and the button memory device has been programmed at the Smart Carrier Station, the information is read from the button memory chip. If the location of the cards found by the bar code reader and card separator match what is on the button memory, it transfers all the button memory information to the flash memory on the Bay Controller Board. Then it is uploaded to the computer Work Station. (If it does not match, the cassette will back up to the load/unload station and a warning message will occur describing the mismatch.) After this data is transferred, the instrument marks the cassette button memory as read in preparation for the next batch of cards to be setup on the cassette using the SCS. The software will link the card results from the instrument to patient demographic data and any previous test results.

NOTE: The button memory chip can be removed from the cassette so that the cassette can be cleaned.

Figure 4-16 and Figure 4-17 shows the button memory chip and contacts on the cassette.

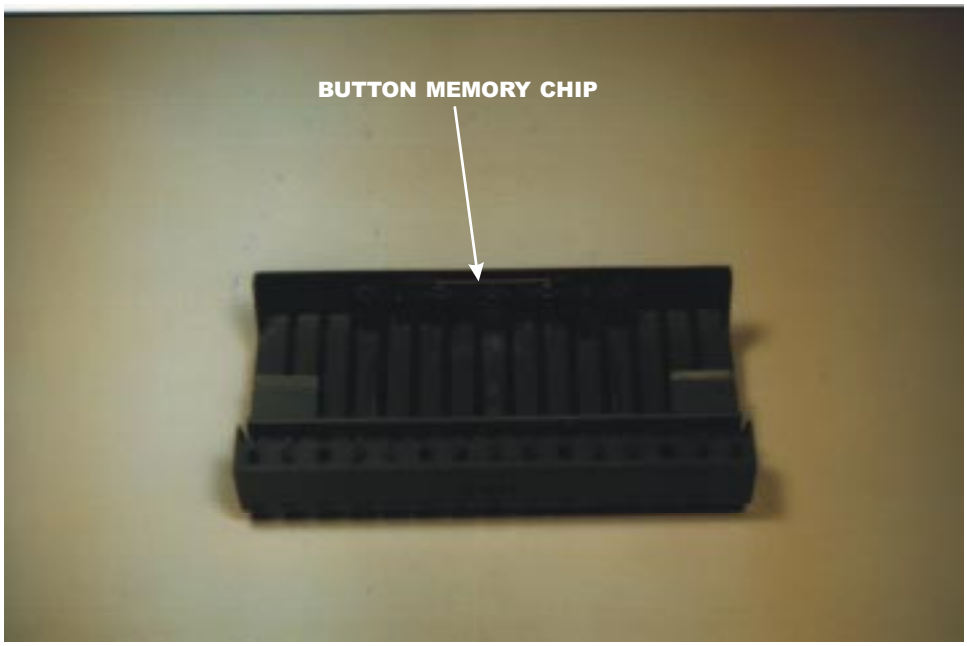


Figure 4-16 Button Memory Chip (under the cassette)

Figure 4-17 Button Memory Chip Contacts

Dispenser/Pipettor Station

The dispenser/pipettor station automatically prepares the organism dilution used for AST (Antimicrobial Susceptibility Testing).

Figure 4-18 shows the location of the dispenser/pipettor station.

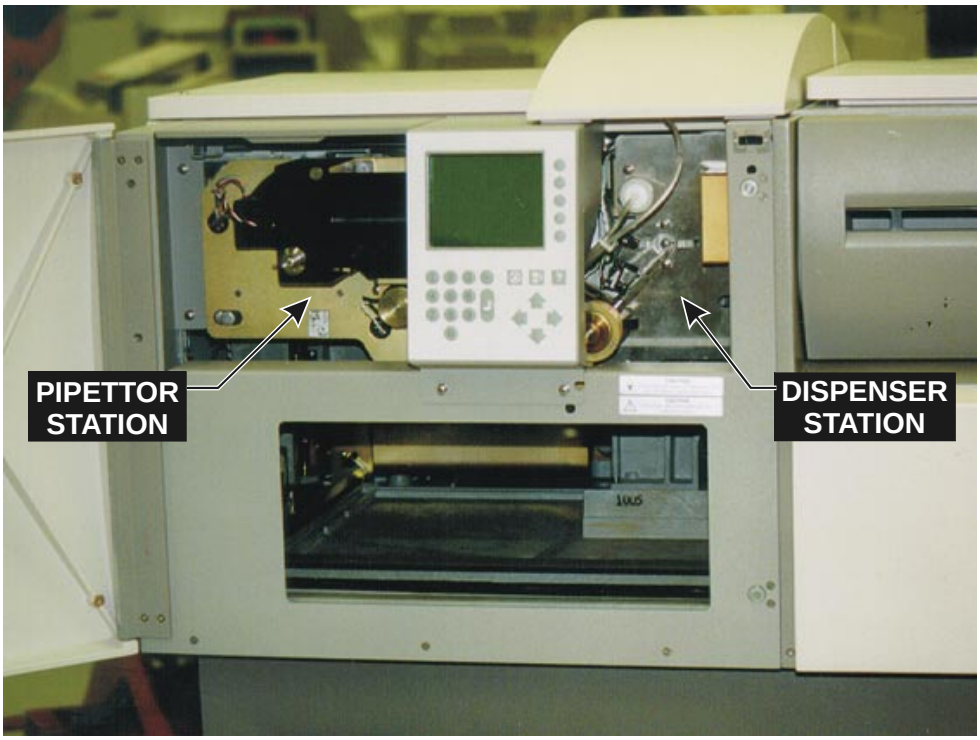


Figure 4-18 Dispenser/Pipettor Station

Dispenser System

The dispenser delivers 2.33 ml – 2.63 ml of sterile saline solution into the test tube of each susceptibility card in a cassette. The dispenser system consists of a 1000ml bag of sterile saline solution in the top center compartment of the instrument and a rotating dispenser assembly at the dispenser/pipettor station.

The 1000ml bag of saline is connected to a disposable dispensing tube assembly. The bag of saline holds enough solution to process about 330 susceptibility cards. Volume tracking software will determine when the saline bag needs replacing and alert the user to this. A drain in the compartment is furnished in the event the saline bag leaks solution. A plastic tube allows the leaking solution to drain into the spill drawer of the base pan.

Figure 4-19 shows the 1000 ml bag of sterile saline solution mounted in the top of the instrument.

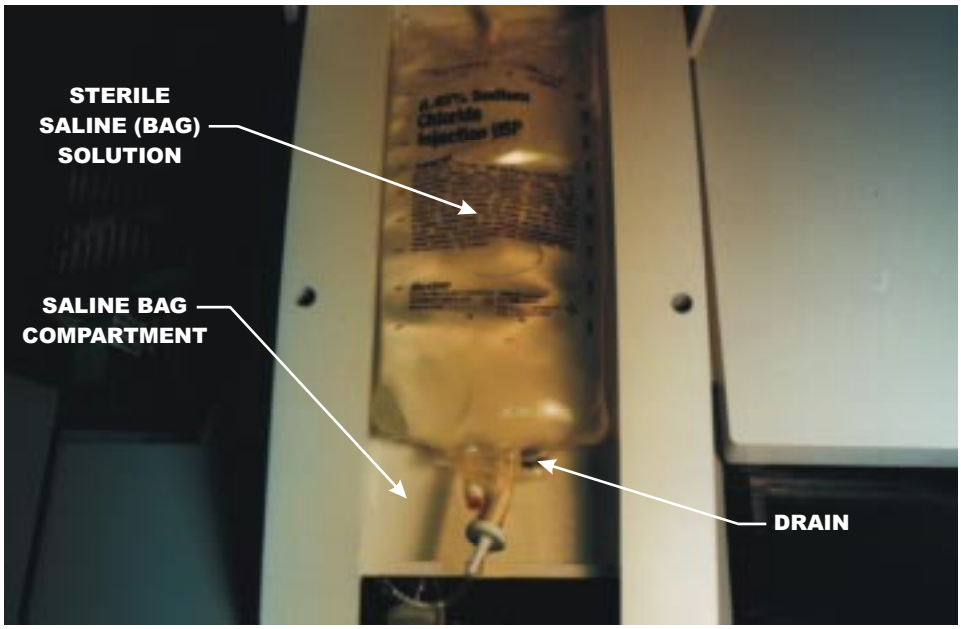


Figure 4-19 1000 ml Sterile Saline Solution

The dispenser assembly consists of a rotating dispenser mounting block assembly, a diluter solenoid assembly, a diluter pump assembly, a diluter motor assembly, an optical sensor board for detecting the dispensing tube saline level, an optical sensor for the rotational fill position of the dispensing tube, a sample prep node (SPN) board and a disposable dispensing tube assembly.

The disposable dispensing tube assembly includes a dispensing tube (chamber), two plastic tubes and a filter to prevent any particulate contamination. One tube connects from the dispensing tube to the saline bag. The other plastic tube connects from the dispensing tube onto the inline air filter, to the diluter pump assembly.

Figure 4-20 shows the dispenser assembly front view. Figure 4-21 shows the location of the diluter pump assembly from the top of the instrument.

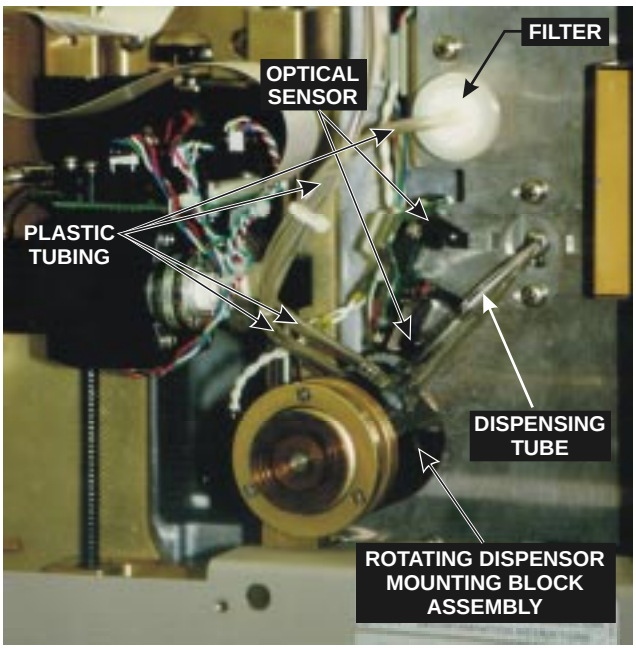


Figure 4-20 Dispenser Assembly (Front View)

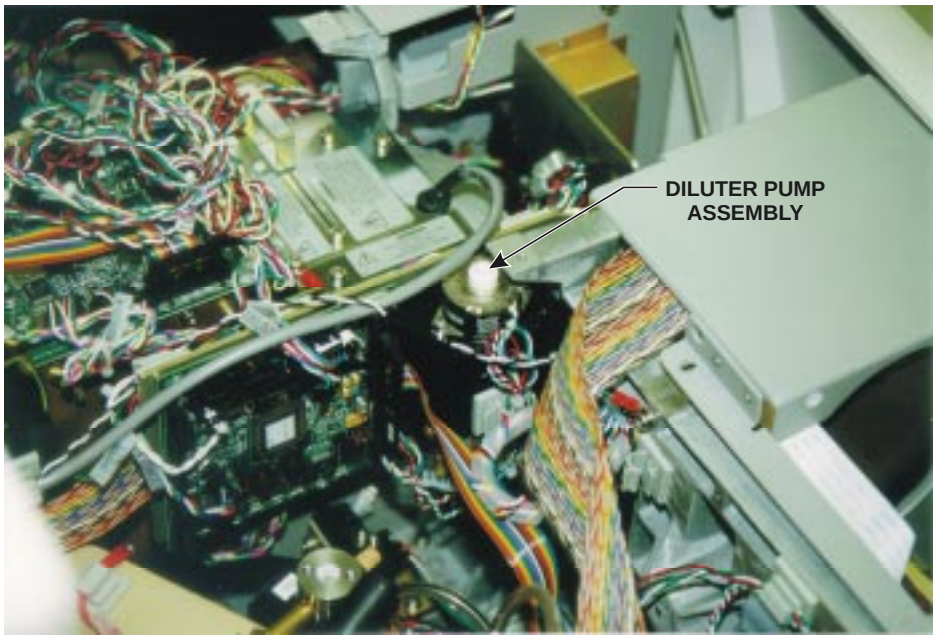


Figure 4-21 Diluter Pump Assembly

When the instrument is set to automatic mode and a susceptibility card is positioned under the dispenser system by the transport, the dispensing tube and mounting block assembly rotate in a counterclockwise direction until the optical sensor flag is sensed by the optical sensor. An electrical solenoid is then compressed which causes a push pin to press into the bottom of the dispensing tube. Gravity causes the saline from the bag to flow into the dispensing tube. When the optical sensor at the tip of the dispenser tube detects the saline, the solenoid releases compression and the flow of saline is stopped.

The diluter motor assembly rotates the dispenser block clockwise at a pre-aligned distance over the susceptibility test tube. The diluter pump is activated, which forces the saline from the dispensing tube at a controlled rate into the test tube. (The controlled rate of air flow prevents splashing of the solution.)

After a preset amount of motor steps, the air pump is shut off. The diluter motor assembly rotates the dispensing tube counterclockwise until the optical sensor detects the signal flag and then the motor stops in its home position.

Pipettor System

The pipettor system transfers a preset volume of the fluid (bacterial suspension) as determined by the bar code of an identification card into the test tube of its companion susceptibility card via a disposable pipette tip. It then leaves the tip into the test tube for disposal. The pipettor system consists of a pipettor pump assembly, a pipettor vertical motor, a pipettor pivoting motor, a drum motor, a pivoting home optical sensor, a vertical home optical sensor, a hall effect sensor, a sample prep node (SPN) board, disposable pipette tips, and a drum (which hold the pipette tips).

Figure 4-22 shows an illustration of the pipettor system.

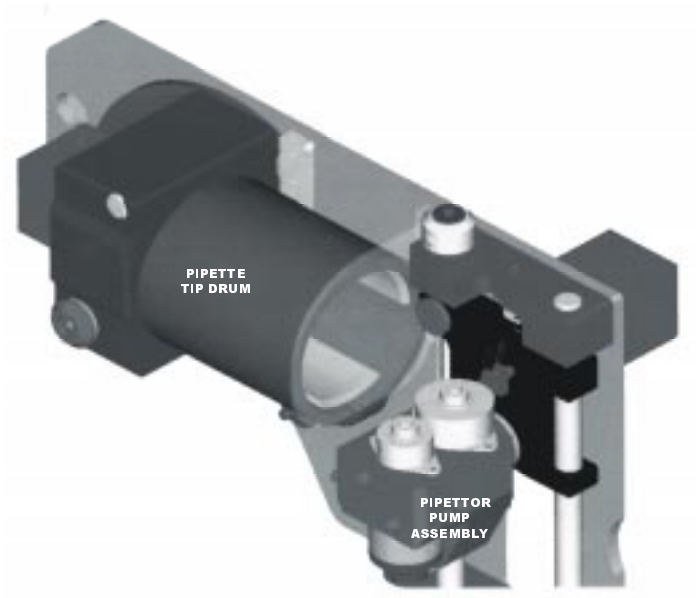


Figure 4-22 Pipettor System

To prevent contamination, the instrument uses single-use disposable pipette tips. Pipette tips are loaded into the pipette tip drum which is designed to hold up to 350 pipette tips. The drum has a slot at the bottom along with rotating fingers to properly deliver a disposable pipette into the slot for the pipettor pump to pick.

The drum can be rotated 90 degrees vertical to allow for loading the pipette tips. When the drum is returned to the horizontal position, the bottom of the drum rests on a horizontal slide. When the pipette tip is in the drum slot, it also rests upon the horizontal slide. A aluminum plate covers the opening of the drum to keep the pipette tips inside the drum. Software will prompt the user when the drum is approaching the empty level.

Figure 4-23 shows the drum in the vertical position loaded with pipette tips.

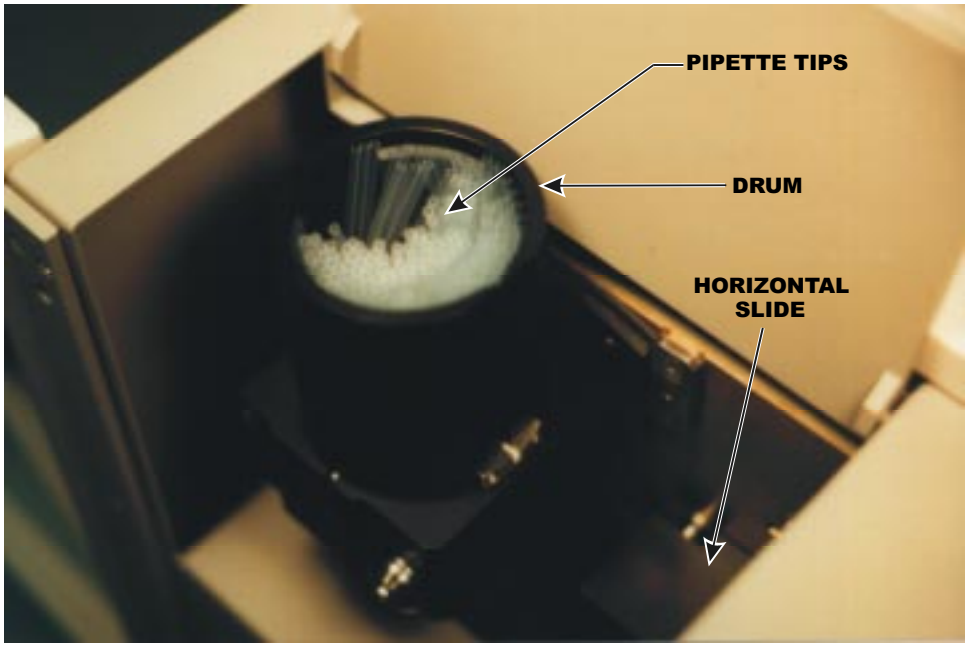


Figure 4-23 Drum Loaded with Pipette Tips

The pipettor pump assembly is mounted on a motor driven rotating base which also raises and lowers the pipette tip to the test tubes by way of a vertical column. The pipettor pump assembly consists of a hollow tapered pin, a taper pin motor assembly, an optical taper pin home switch assembly, a pipettor pump motor assembly, an optical pipettor pump home switch assembly, and a pipettor snout board (which includes a pressure transducer).

Figure 4-24 shows the pipettor pump assembly in the instrument.

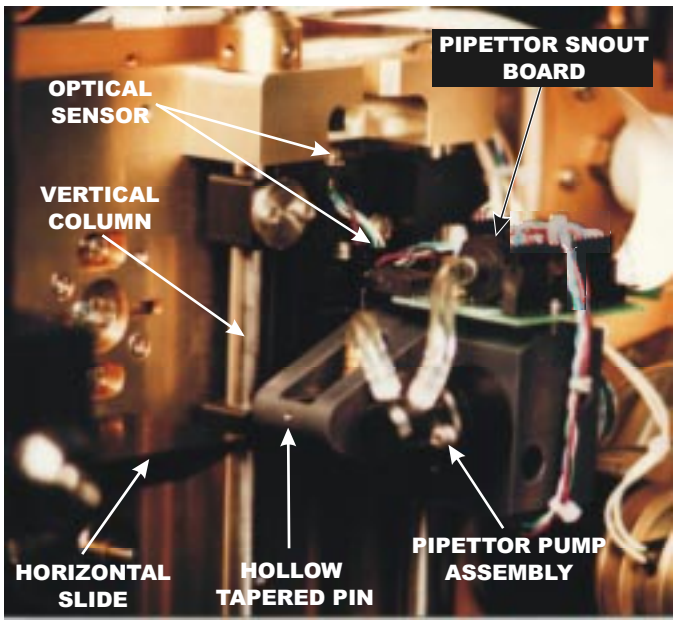


Figure 4-24 Pipettor Pump Assembly

When the instrument is set in automatic mode and a identification card is positioned under the pipettor system by the front transport, the pipettor pump assembly initializes to its home position. Next the fingers inside the drum begin to rotate allowing a pipette tip to drop onto the horizontal slide between the drum slot. The tapered pin motor assembly extends the hollow tapered pin into the pipette tip and presses it against the straw sensor pad. The vacuum sensor verifies the tip is attached. The solenoid for the horizontal slide activates and the slide retracts, allowing the pipettor pivoting motor to rotate the pipette tip down (vertical).

With the pipette tip directly over the test tube, the pipettor vertical motor lowers the pipette tip into the test tube a preprogrammed distance. The pipettor pump motor assembly draws a preprogrammed amount of bacterial suspension solution from the identification tube into the pipette tip. The vertical column raises the pipette tip from the tube.

The transport system moves the cassette to position the adjacent susceptibility test tube under the pipette tip. The pipette tip containing the bacterial suspension is lowered into the test tube. The pipettor pump motor assembly first verifies there is saline and then works to deliver the suspension into the test tube where it mixes with the saline. A volume of air is then slowly bubbled through the tip to mix the solution.

The tapered pin motor assembly retracts the hollow tapered pin, forcing the contaminated pipette tip off of the tapered pin. Then each contaminated pipette tip will remain in its corresponding sample tube for disposal.

Vacuum Station

The vacuum station fills the test cards with the inoculum solution using vacuum displacement inside the vacuum chamber. The vacuum station consists of the vacuum chamber, a vacuum pump, vacuum sealer SPN board with a mounted pressure transducer, vacuum assembly vertical motor, timing belt, vacuum home sensor, vacuum encoder sensor, solid state relay, proportional valve, 4-way valve, air filter and the associated pneumatic components.

Figure 4-25 shows the vacuum station vacuum chamber and pneumatic components. Figure 4-26 shows the vacuum pump mounted in the instrument.

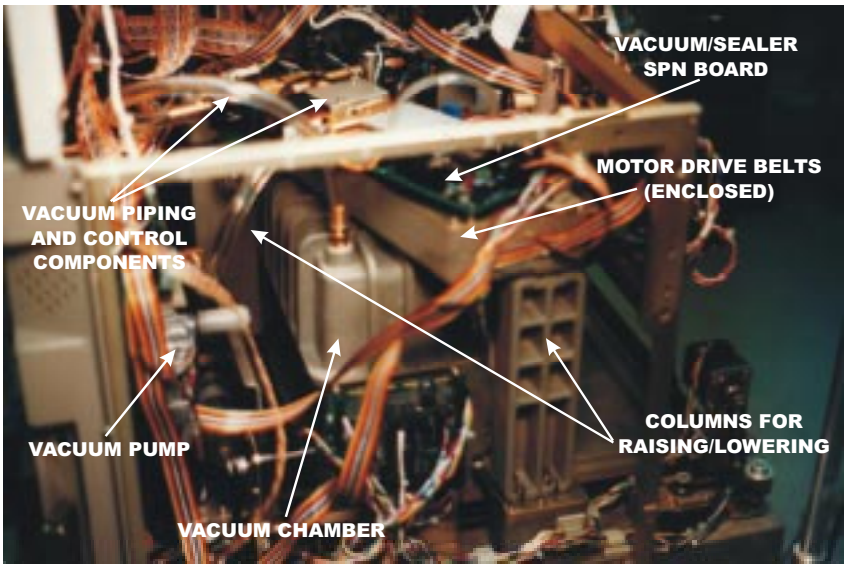


Figure 4-25 Vacuum Station Vacuum Chamber and Pneumatic Components

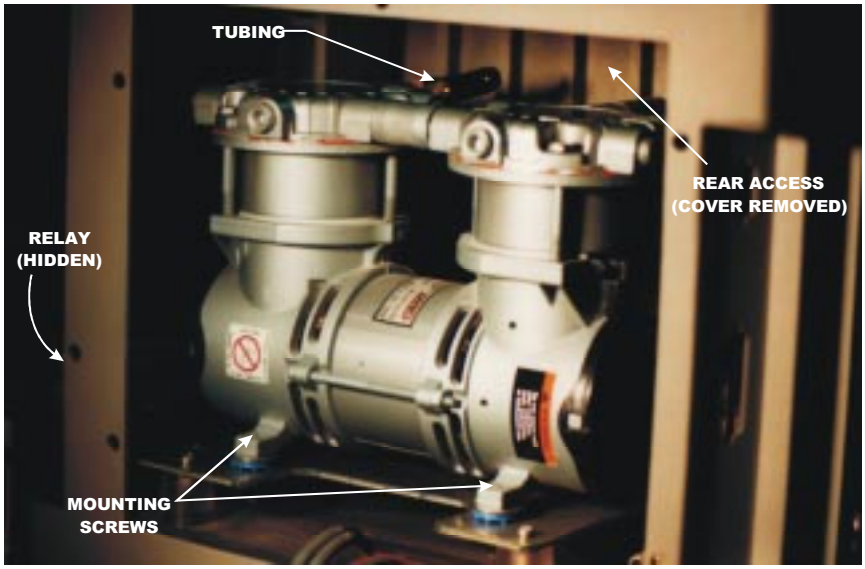


Figure 4-26 Vacuum Station Vacuum Pump (Back View)

The top of the vacuum chamber is mounted on two vertical lead screw columns driven by a drive motor and drive belt arrangement located on top of the vacuum chamber assembly. The pneumatic components and vacuum pump make up the rest of the vacuum station.

The vacuum chamber is a formed plastic designed to cover the cassette and rest on the boat surface. The vacuum chamber has a seal surrounding it's bottom which when lowered makes contact with the boat surface, completing the chamber.

NOTE: The seal on the vacuum chamber should be cleaned periodically with a disinfectant and warm water.

Figure 4-27 shows the top section vacuum chamber seal.

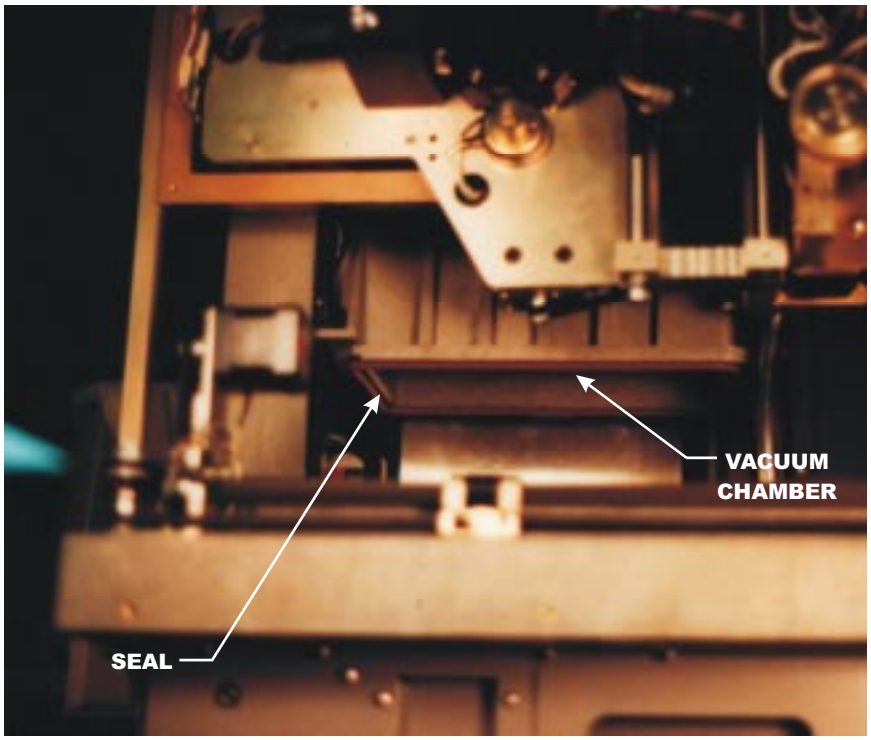


Figure 4-27 Vacuum Chamber Seal

Figure 4-28 shows the pneumatic diagram for the vacuum chamber.

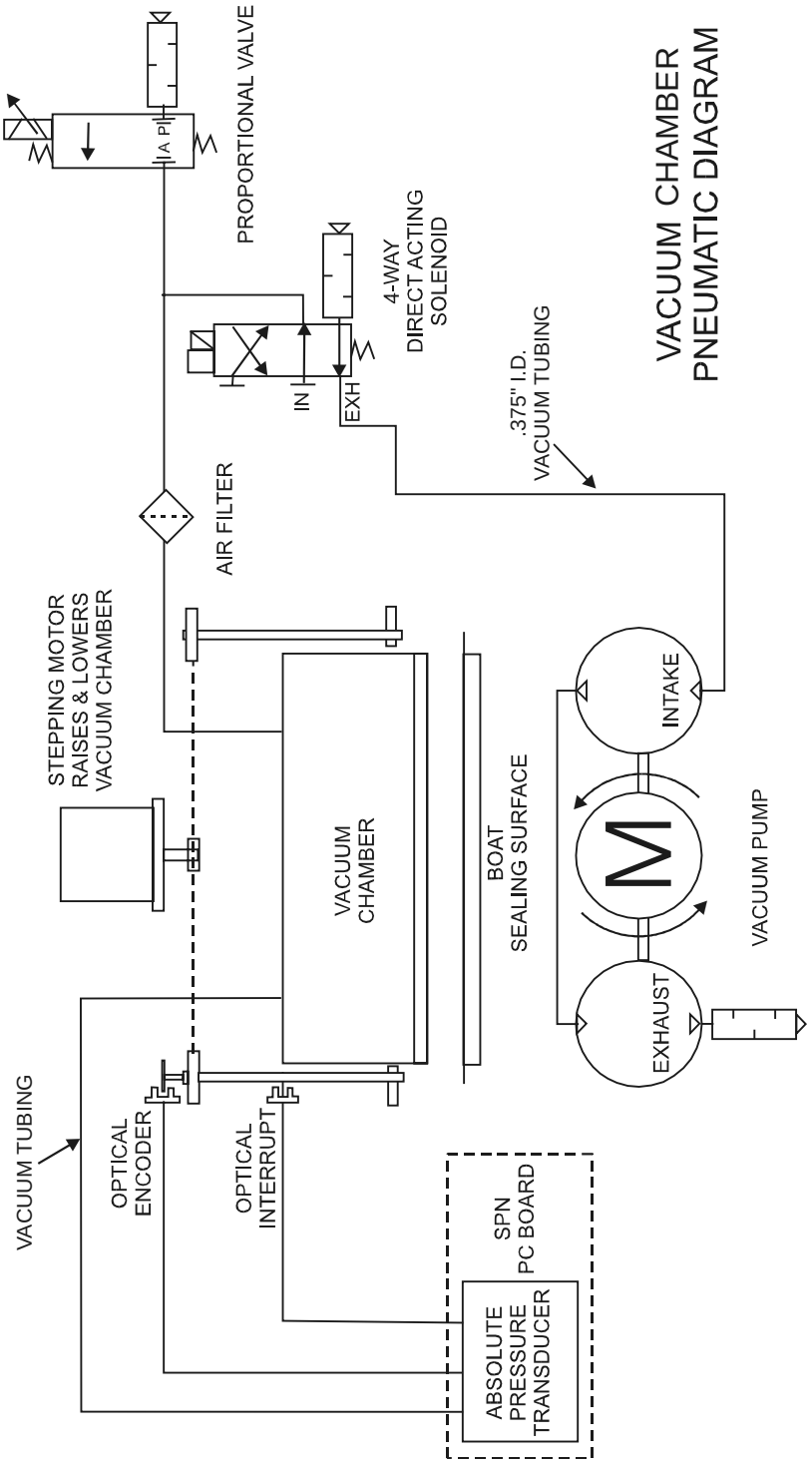


Figure 4-28 Vacuum Chamber Pneumatic Diagram

The transport system delivers a cassette to the vacuum station for filling the test cards with the inoculum solution. When the vacuum pump is turned on, it begins drawing free air through the filter/muffler attached to the 4-way solenoid valve. To fill the test card the following sequence occurs:

1. The vacuum chamber lowers over the boat and cassette.
2. The proportional valve is opened 100%.
3. The 4-way direct acting solenoid is energized and air is evacuated or pumped out of the vacuum chamber through the air filter and the 4-way solenoid valve.
4. The absolute pressure transducer monitors the vacuum chamber pressure decreasing and sends a proportional continuously changing voltage output to the SPN board.
5. The continuously changing voltage signal is sampled by the SPN board at regular intervals and the rate of change is compared to the programmed rate (Figure 4-29) to pump down the vacuum chamber (approx. 25 seconds).

    - If the rate of change is *too fast*, a higher voltage signal is sent to the proportional valve which opens wider to slow down the amount of air being drawn from the vacuum chamber by the vacuum pump.
    - If the rate of change is *too slow*, a lower voltage signal is sent to the proportional valve closing down the valve to speed up the amount of air being drawn from the vacuum chamber by the vacuum pump.

6. When the vacuum chamber is pumped down to the vacuum target pressure (0.89+/- 0.04 psia), the vacuum pump turns off, the 4-way solenoid valve closes, and the proportional valve is closed for a total of five seconds.. The absolute pressure transducer continues to monitor the vacuum chamber pressure sending the voltage signal to the SPN board.

NOTE: Air is forced from inside the test card via the transfer tube and bubbles up through the suspension. The channels and wells inside the test card are now in a vacuum.

7. After five seconds, the proportional valve is opened gradually to raise the pressure inside the vacuum chamber. The absolute pressure transducer continues to monitor the vacuum chamber pressure sending the voltage signal to the SPN board. The continuously changing voltage is sampled by the SPN board at regular intervals and compared to the programmed rate (Figure 4-29) to return to atmospheric pressure (approx. 60 seconds).
   - If the rate of change is *too fast*, a lower voltage signal is sent to the proportional valve closing down the valve to slow down the amount of air being drawn into the vacuum chamber to return to atmospheric pressure.
   - If the rate of change is *too slow*, a higher voltage signal is sent to the proportional valve which opens wider to speed up the amount of air being drawn into the vacuum chamber to reach atmospheric pressure.

☞ **NOTE:** The increasing air pressure inside the vacuum chamber forces the suspension in each test tube to flow through the transfer tube and into the channels and wells of the card.

8. The proportional valve is opened 100% at the completion of the return to atmospheric pressure and held open while the vacuum chamber is raised from the cassette.
9. The proportional valve is closed and the system is ready to run again.

Throughout the entire cycle, the air pressure inside the vacuum chamber is monitored. This is to ensure that the rate of change of pressure and the maximum vacuum value is maintained without boiling the sample.

Figure 4-29 shows the theoretical vacuum cycle chart followed for vacuum chamber operation.

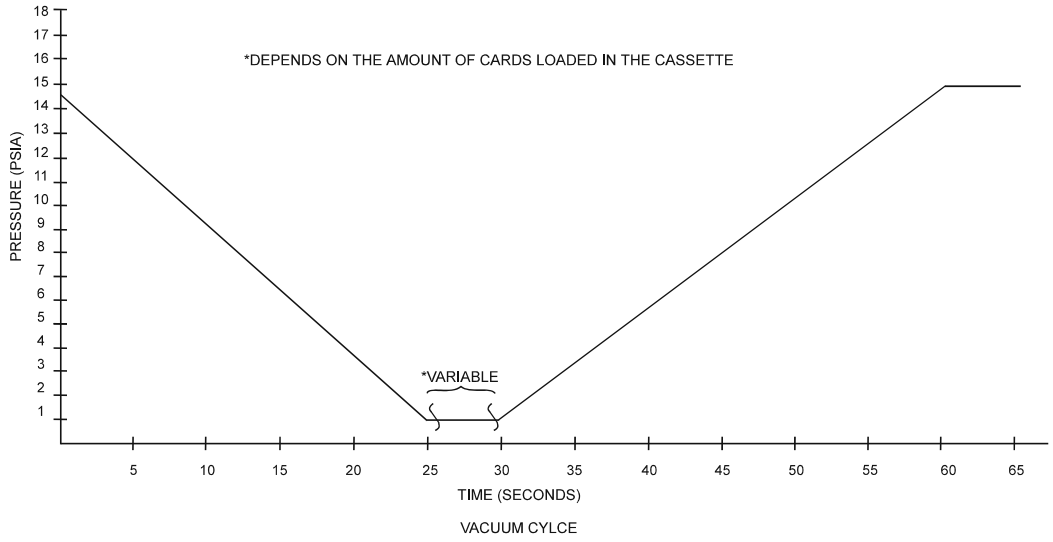


Figure 4-29 Theoretical Vacuum Cycle Chart (Reference only)

Card Sealer Station

The card sealer station completes the function inside the instrument that prepares the test cards for incubation and reading. Before a test card can be incubated and read, the wells must be sealed off from the outside environment. The card sealer station melts and seals the transfer tube that delivered the inoculum to the card from the test tube.

During the last part of the vacuuming process, a hot wire from the sealer station drops down and begins heating. As the boat and cassette move through the sealer station the hot wire comes in contact with each transfer tube causing the plastic to melt, therefore cutting the transfer tube. The majority of the transfer tube then falls into its associated test tube. Remaining in the test card is the sealed stub 1 mm-2.5 mm from the cards edge. Once the entire cassette of cards has been sealed, the hot wire retracts back into a wire shield housing where it cools. (In the event of a halted transport, the sealer wire will also retract and stop heating until the problem is corrected.)

The card sealer station consists of a nicrome wire (sealer hot wire), a hot wire motor assembly to raise and lower the hot wire, and an optical sensor to monitor the hot wire up/down position. The hot wire is controlled by the vacuum sealer SPN Board.

Figure 4-30 shows the hot wire, which melts and seals the transfer tube of the test cards.

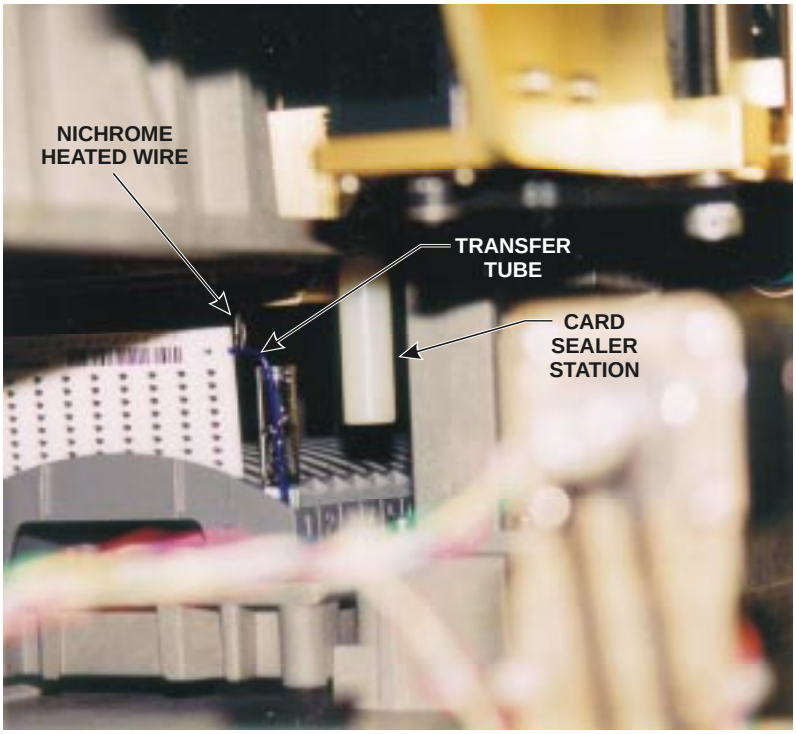


Figure 4-30 Card Sealer Station Hot Wire

Figure 4-31 shows the hot wire optical sensor assembly.

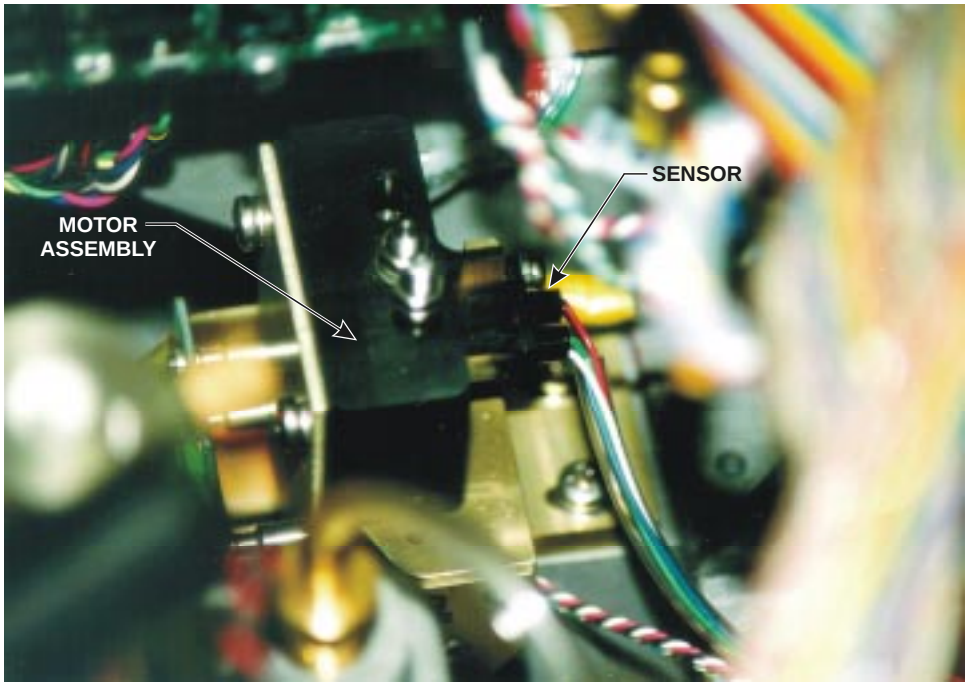


Figure 4-31 Hot Wire Optical Sensor Assembly (Top View)

Reader / Incubator Processing System(s)

The ***VITEK•2®*-60** system is made up of one set of the following primary internal components. The ***VITEK•2®*-120** Reader / Incubator processing system is made up of two sets of the following primary internal components (labeled section A & section B):

- Auto Loader Station
- Carousel Card Ejector
- Carousel Incubator
- Reader System
- Waste Collection Station

Auto Loader Station

Test cards transported and processed from the card sealer station are transferred into the slots of the carousel at the incubator auto loader station. This station consists of a motor driven rack gear attached to an auto loader pusher and an auto loader home sensor.

When a boat and cassette reach the card loading station, each card will be pushed by the auto loader from the cassette into a slot of the 60-position carousel. Then the auto loader will retract back to the auto loader home sensor.

Figure 4-32 shows the test cards ready to be pushed into the carousel at the incubator auto loader station.

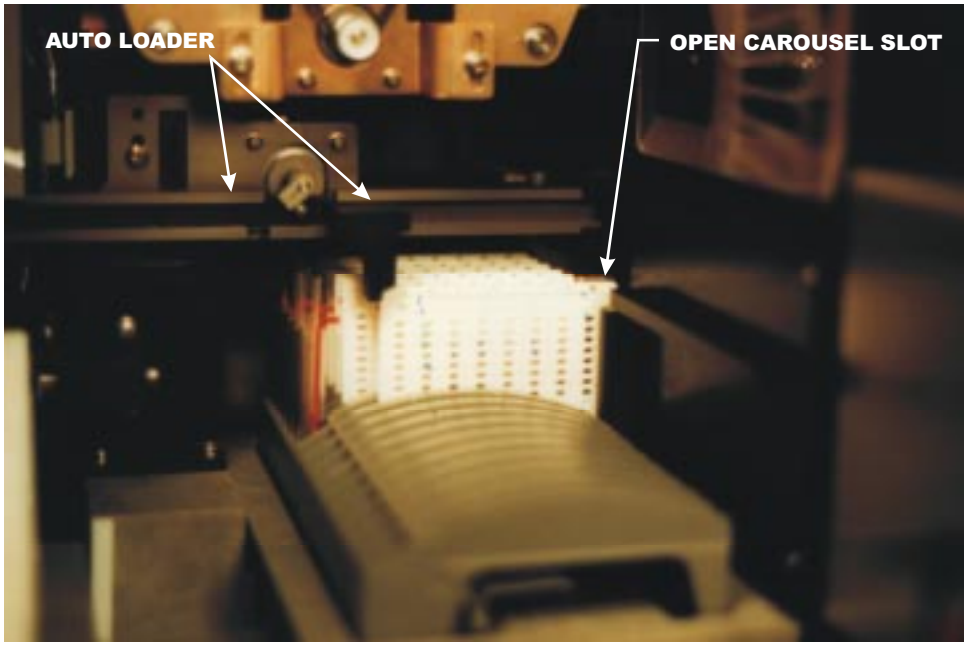


Figure 4-32 Incubator Auto Loader Station

Carousel Card Ejector

After the cards have been loaded into the carousel, they must complete their first read. Identification cards are immediately read by the reader, followed by susceptibility cards. Then the cards are read every fifteen minutes from its first read. (Initially, this time may vary if more that one cassette is loaded.) To accomplish this the card ejector must push the card out of the carousel onto the reader belt and card guide.

The card ejector assembly consists of an ejector guide, ejector blade, card ejector motor, tray drive gear, and ejector home sensor.

The card ejector motor turns a rack gear attached to the card ejector blade. The motor fully extends the card ejector blade, which pushes the card from the carousel to the reader. The ejector blade then retracts to the ejector home sensor.

See Figure 4-33 for some of the ejector components.

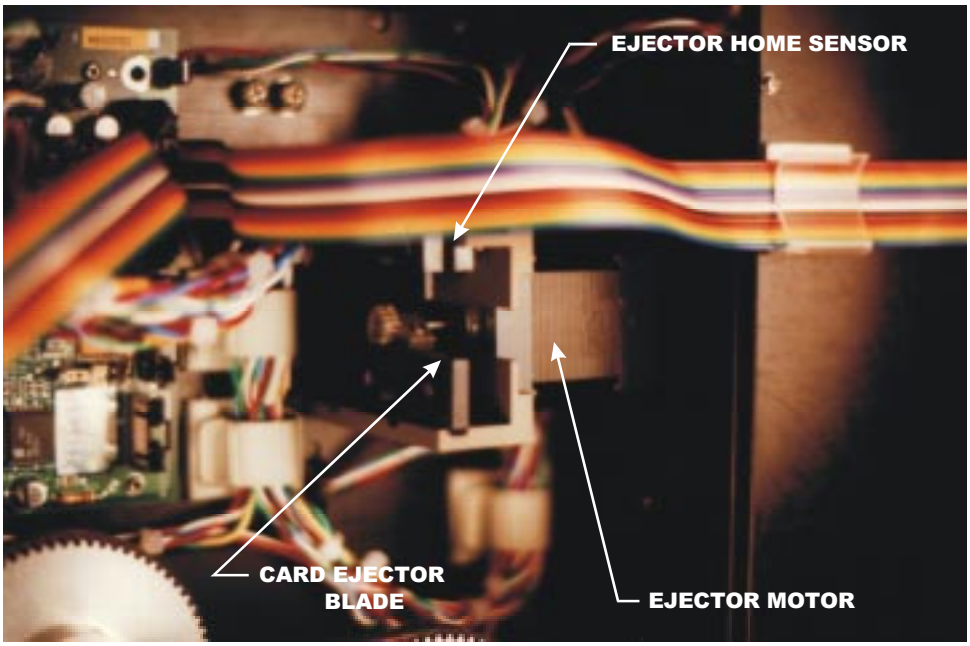


Figure 4-33 Ejector Components

Carousel Incubator

The carousel incubator is comprised of a rotating carousel capable of holding up to sixty (60) test cards contained inside an incubation chamber with a heater, two thermistors and two circulating fans used to incubate the cards during a test. A incubator motor for the carousel exists outside the incubation chamber at the rear of the instrument. Positioning the carousel is accomplished by three (3) optical sensors. The first is the incubator top sensor which reads the positioning slots on the outside edge of the carousel quadrants. This sensor is used to align the carousel slots with the reader, so the ejector assembly can push the card into the reader to be read. The second is the incubator home sensor, which is located behind the carousel (not shown). It is used to determine the carousel home position (slot 0). The third is the incubator bottom sensor located at the bottom of the carousel (not shown). It is used for proper positioning when cards are loaded from the auto loader station into the carousel. The temperature inside the incubator is controlled at an average of 35.5 ± 1°C (95.9ºF ± 18ºF).

Figure 4-34 shows the carousel system and components in the instrument.

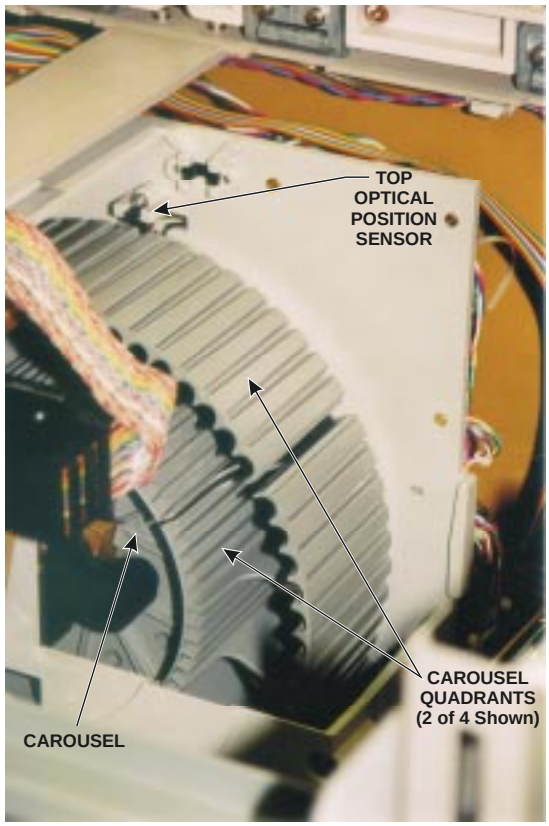


Figure 4-34 Carousel System and Components

The auto loader station loads the carousel with the test cards. The carousel holds the test cards throughout the complete incubation cycle. The cards are removed from the carousel once every fifteen minutes for optical measuring. The carousel is divided into four sections called a quadrant. Each carousel quadrant can be removed independently for easy cleaning.

Incubator Temperature Control

The incubator heater is monitored and controlled through the use of two remote precision thermistors monitored by an A/D converter. One thermistor is located below the heater and the other is located behind the carousel quadrants and the right hockey table plate (not shown). These inputs are compared to voltages produced by high precision resistors. This design enables the cards to be held at an average temperature of 35.5± 1°C (95.9ºF ± 18ºF).

Air inside the incubator is circulated by a fan above the heater assembly, across the heater to a second fan which pushes the heated air through a series of holes on a hockey table plate, through the carousel card slots and back up to the fan above the heater. The carousel motor rotates the carousel inside the incubator. Figure 4-35 shows the incubator heater and components.

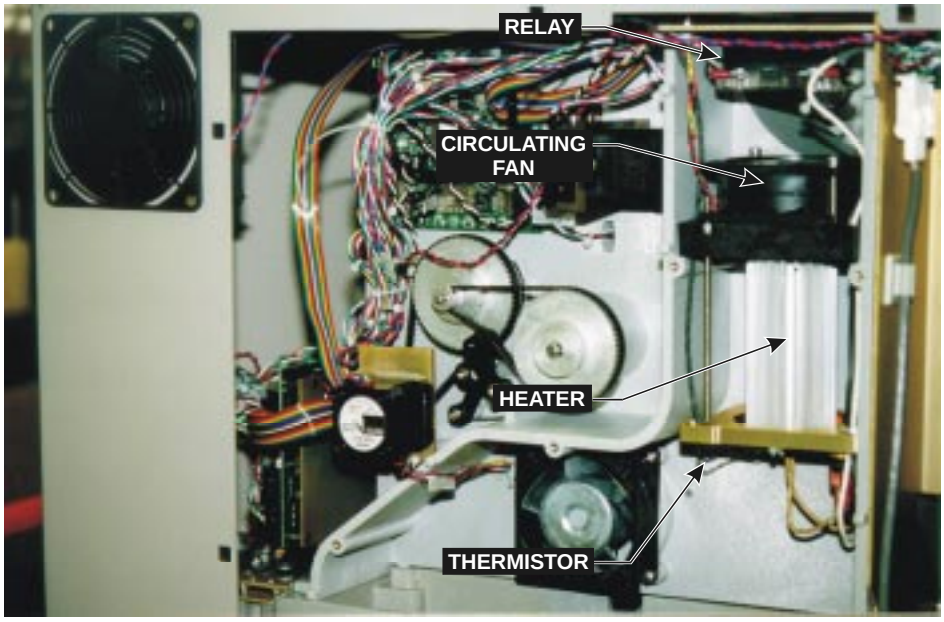


Figure 4-35 Incubator Heater and Components

Reader System

The reader system of the instrument performs the card positioning, identification, and susceptibility analyses by continually monitoring the growth of organisms inside the wells of the test cards. After the card ejector pushes the card out of the carousel onto the reader belt and card guide, the reader transports the card through the various optical systems and then returns it to the incubator. Two different optical systems perform the analysis of organism growth within the test wells; transmittance optical system and fluorescence optical system.

Figure 4-36 shows the location of the optics system and components of the instrument.

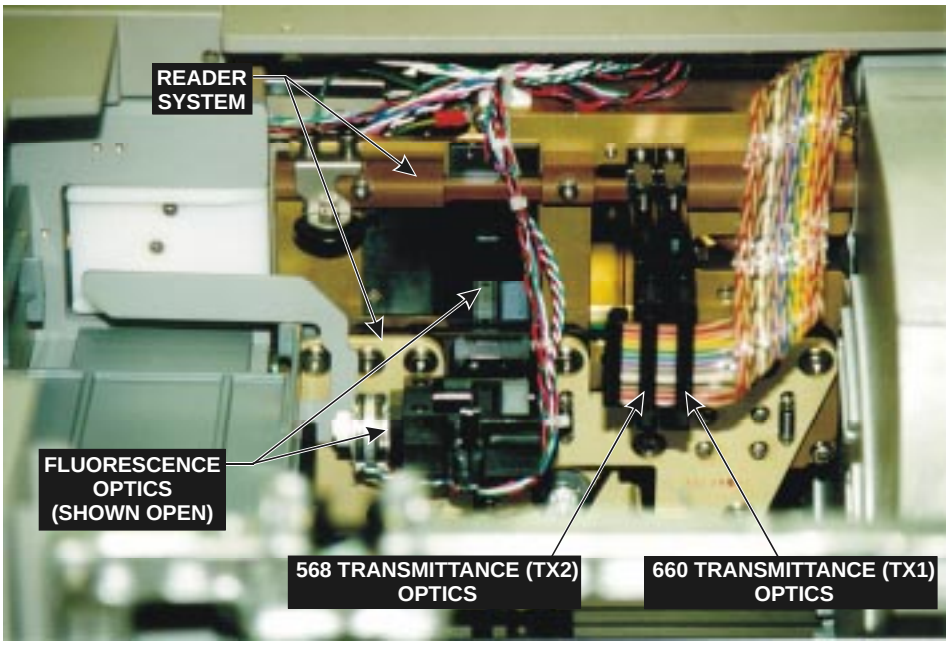


Figure 4-36 Optics System and Components

The ***VITEK•2®*-60** reader system is comprised of an optical/mechanical head assembly that includes a drive belt motor, a reader timing belt, a spring loaded roller plate assembly, a cam assembly, a fluorescence optical system, a 660 nM transmittance optical system (TX1) and a 568 nM transmittance optical system (TX2).

The ***VITEK•2®*-120** reader system is comprised of two reader systems. Reader Section A, which includes the same components as the 60 capacity instrument and Reader Section B, which only includes the 660 nM transmittance optical systems (TX1). (There will be an upgrade option allowing installation of a second fluorescence and a 568 nM transmittance to the 120 capacity instrument.)

The card ejector pushes a card out of the carousel slot onto the motor drive belt of the reader system. The reader timing belt turns counterclockwise transporting the card through the optics system and verifies the cards presence by counting the interrupts on the base of the card. Next the timing belt turns clockwise again transporting the card through the optics system, this time positioning the card for well readings. Once read, the cam assembly pushes the card into the same carousel slot for incubation until the next reading cycle. The reader reads each card in the carousel once every fifteen minutes. When the card is complete (a duration determined by card type and dictated through the software), the card travels through the reader system into the waste collection tray at the front of the instrument. The stacker push plate fully extends, placing the card between the card stop of the tray and a spring loaded stacker rack, completing the card cycle.

Figure 4-37 shows the various components of the optical system of the reader.

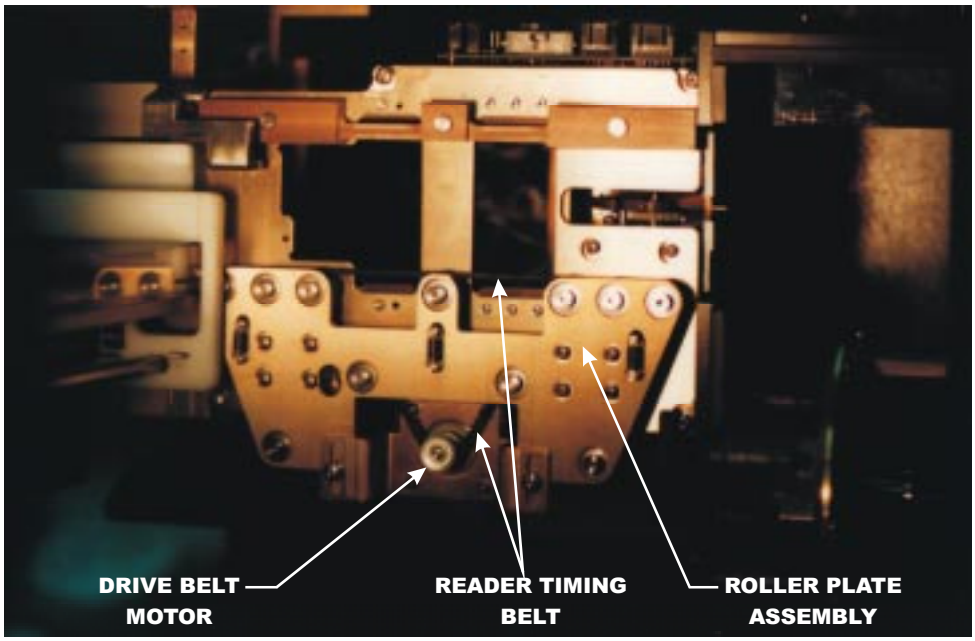


Figure 4-37 Reader System

Transmittance (TX) Optical System

Transmittance (TX) optics use visible light to directly measure organism growth. These optics are based on an initial light reading of a well before significant growth has begun. Periodic light transmittance samplings of the same well measure organism growth by how much light is *prevented* from going through the well.

The TX optical system is an eight channel configuration, meaning it can read eight wells in a column (rows 1-8, top to bottom) for a total of 64 wells per card. The emitter uses LEDs for the light source at present wavelengths of 660 nM (TX1) and a 568 nM (TX2). The detector captures the LED light using silicon photodiodes. The emitter and detector housings are hinged for ease of servicing or access to the optics area. Up to three TX optical modules can be used in the instrument.

The system scans across the well in 16 steps and takes 3 readings per step. The readings are smoothed and the peak value is chosen. (It ignores any readings resulting from air bubbles.) The TX optics calibration is verified before each reading and then electronically re-calibrated if necessary.

Figure 4-38 shows a cross section of the TX optical system.

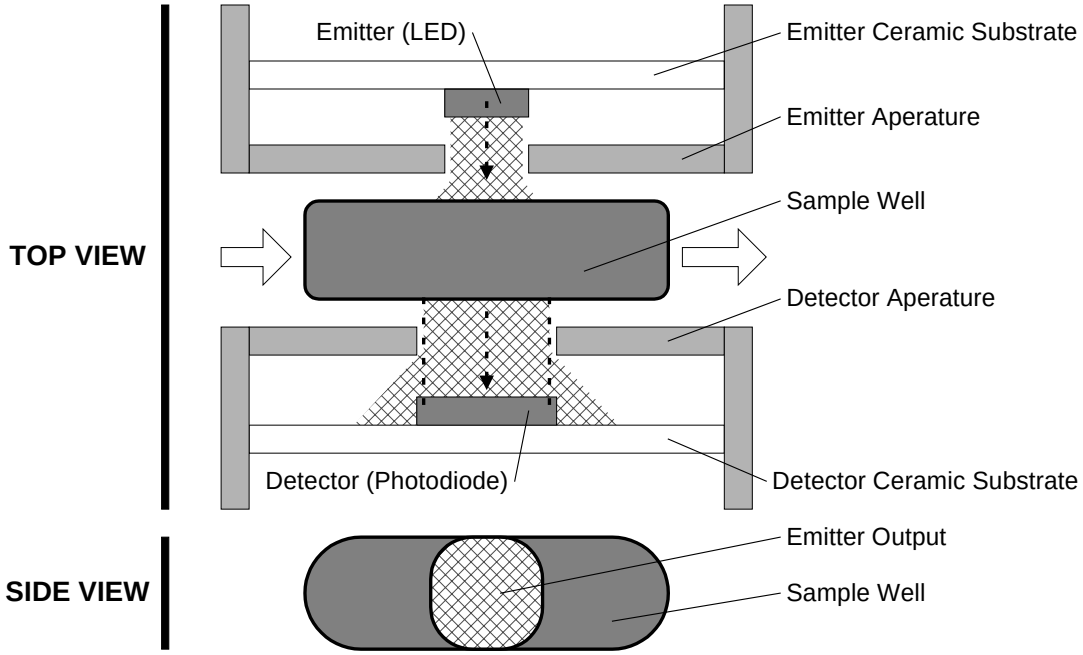


Figure 4-38 TX Optical System - Cross Section

Fluorescence Optical System

DANGER: Do not remove the fluorescence power supply cover with system turned on. The fluorescence power supply casing contains a 600V Power Supply and an ultraviolet flashlamp.

The fluorescence (FL) optics detect the growth of organisms indirectly. It detects a chemical byproduct of their growth rather than the organisms themselves. This chemical, called a fluorophore, absorbs light at a wavelength of 365 nM and immediately re-emits the light at a different wavelength of 445 nM.

The FL optical system is comprised of a hinge mounted motorized optical shuttle, fluorometer aperture, optical head, ultraviolet flashlamp assembly, peak and photodiode detector boards in an EMI box, and the 600V power supply.

Figure 4-39 shows the FL optical system components.

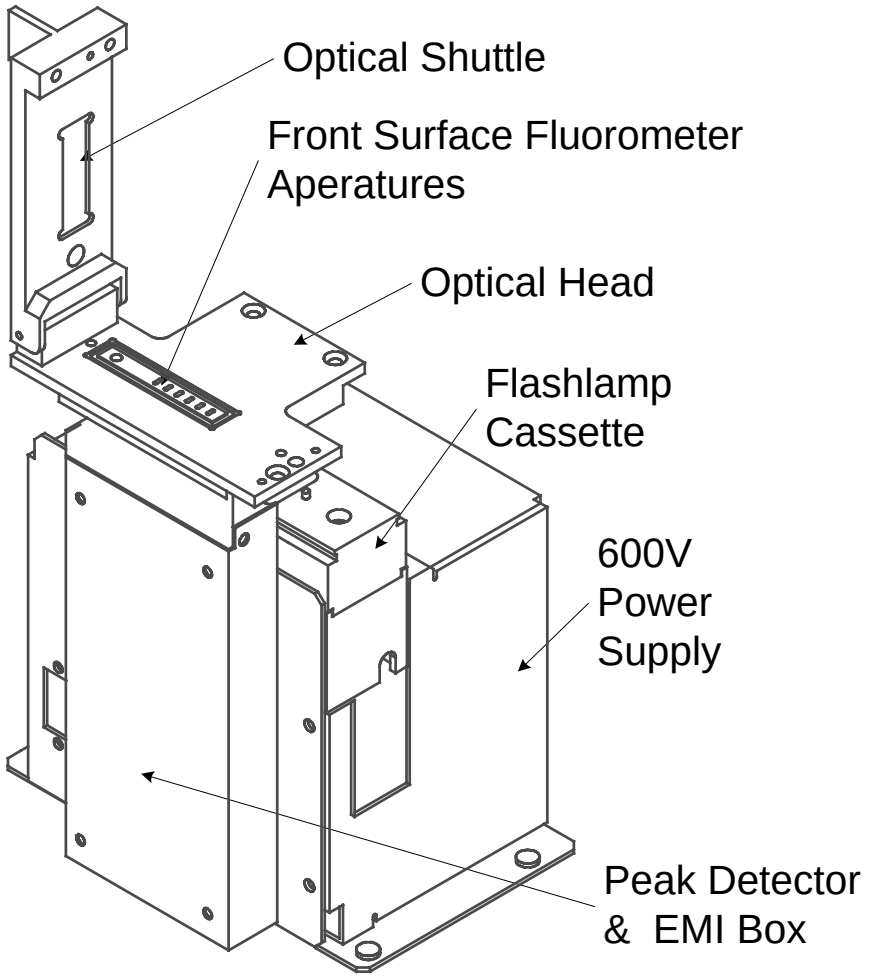


Figure 4-39 Fluorescence Optical System

The FL optical system is a six channel configuration meaning it will read 6 wells in a row (rows 2-7, top to bottom) for a total of 48 wells per card. The emitter is a xenon flash tube and optical filters delivering 10 flashes per reading. The fluorophore re-emits light from the xenon flash tube and this re-emitted light is captured by the fluorescence detector. The biochemical in these wells is designed to produce this substance in direct proportion to the growth of the organisms. The amount or re-emitted light produced by the fluorophore provides the level of growth of the organism.

From the 10 readings per well the firmware removes the two highest and two lowest numbers and then averages the remaining 6, which becomes the final value for that well on that particular read.

The fluorescence optics require a initial liquid calibration using 4-MU bio prepared standard. Another liquid calibration should follow every 6 months. An automatic calibration verification is performed by the instrument after power up, two hours after power up and then every 24 hours using the standard as its reference. If the verification fails, it will auto-calibrate up to a specific range. It will not perform a automatic calibration if identification cards are processing. It waits until cards have completed and have unloaded. If identification cards continuously process for 5 days, the instrument will generate an error message stating that the fluorescence is approaching calibration limits.

Figure 4-40 shows a cross section of the FL optical system.

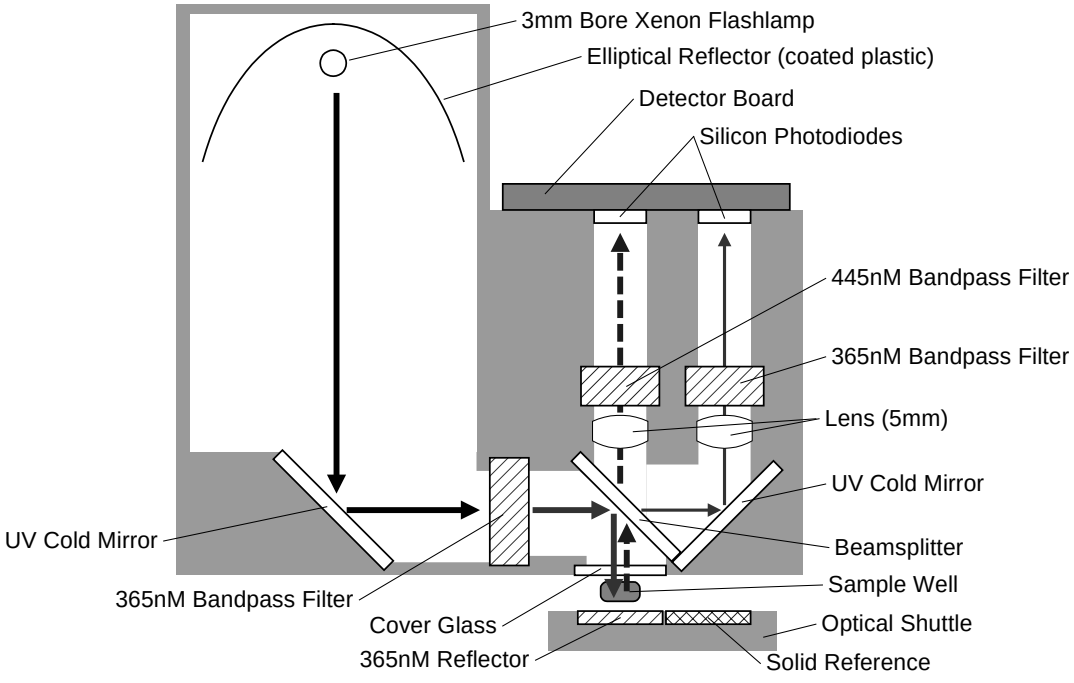


Figure 4-40 FL Optical System - Cross Section

NOTE: Both the TX and FL optical systems should be cleaned periodically using lens paper or an alcohol pad with the excess liquid squeezed out, followed by the lens paper.

Waste Collection Station(s)

The waste collection station is located above the cassette load/unload station at the front of the instrument. The ***VITEK•2®*-60** includes one waste collection station and the ***VITEK•2®*-120** includes two. Access to the station(s) is gained by pivoting the waste collection door down. The waste collection station consists of a waste collection tray, a snap action sensor, a stacker motor, a stacker push plate, a push rack home sensor, a push plate and a stacker empty sensor.

Each station houses up to 60 cards which are held upright and tight by the spring loaded pressure plate and tray card stop as the tray fills. A snap action sensor switch detects when the waste collection tray has been removed for emptying. When the tray is replaced, the control system starts a internal counter that monitors the cards ejected into the tray and alerts the operator when the tray approaches full.

Figure 4-41 shows the waste collection station and tray.

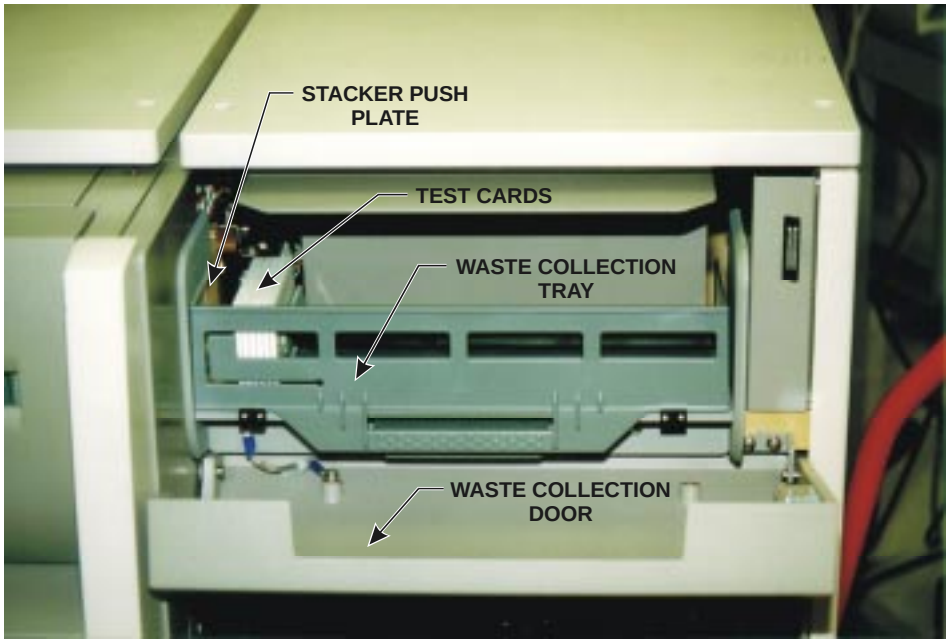


Figure 4-41 Waste Collection Station

Upon completion of the card testing by the ***VITEK•2®***, the test cards are ejected from the carousel and are transported by the reader system to the waste collection area. The stacker push plate fully extends, placing the card between the card stop of the tray and a spring loaded pressure plate completing the card ejection cycle.

Figure 4-42 shows the card ejector area.

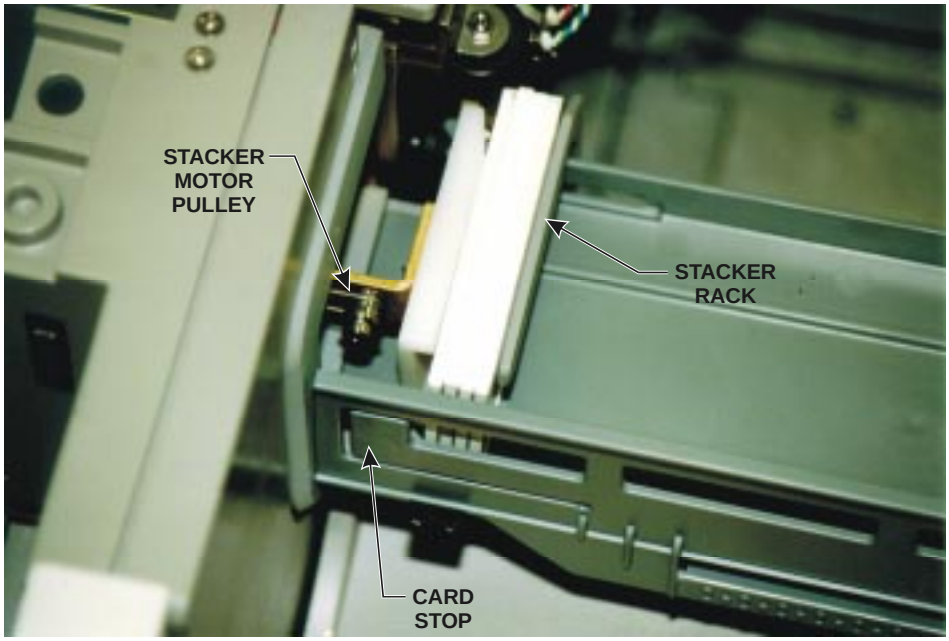


Figure 4-42 Card Ejection Area

NOTE: The waste collection tray should be emptied whenever a new cassette is loaded into the instrument and also should be cleaned periodically.

NOTE: Cards can be ejected on command through the workstation or through the instrument diagnostics screen.

WARNING! Ejected cards cannot be reinserted into the ***VITEK•2®*** instrument. Ensure that all card processing has been completed before commanding a card to eject.

WARNING! Do not reinsert cards in waste collection tray once they have been removed.

System Electronics

The internal electronic architecture of the ***VITEK•2***® integrated system is a distributive control system comprised of two types of microprocessor based controller boards connected with a serial network. Instrument electrical power is comprised of a power supply cabinet arrangement serving all internal power consumption requirements.

The ***VITEK•2***® system electronics include the following primary internal components:

- Bay Controller Board (BCB)
- Head Controller Board(s)
- Sample Prep integrated Network (SPN) Boards
- DC Power Supply Board
- Power Supply Cabinet

Figure 4-43 and Figure 4-44 shows a block diagram and location of the PC boards inside the ***VITEK•2®*** and ***VITEK•2® XL*** instruments.

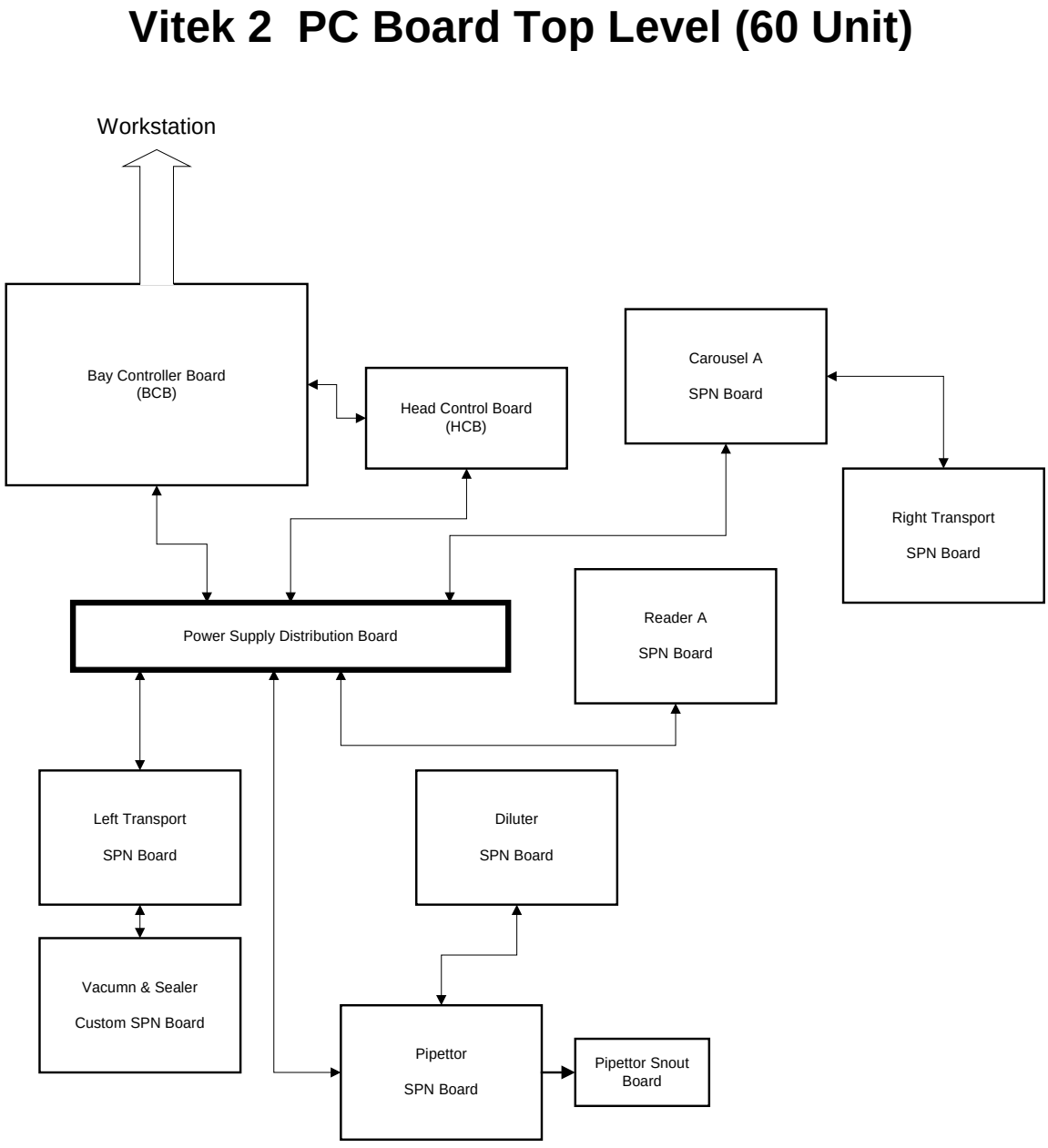

Vitek 2 PC Board Top Level (60 Unit)
Workstation
Bay Controller Board (BCB)
Head Control Board (HCB)
Carousel A SPN Board
Right Transport SPN Board
Power Supply Distribution Board
Reader A SPN Board
Left Transport SPN Board
Diluter SPN Board
Vacumn & Sealer Custom SPN Board
Pipettor SPN Board
Pipettor Snout Board

Figure 4-43 ***VITEK•2®*** PC Board Top Level Block Diagram

Vitek 2 PC Board Top Level (120 Unit)

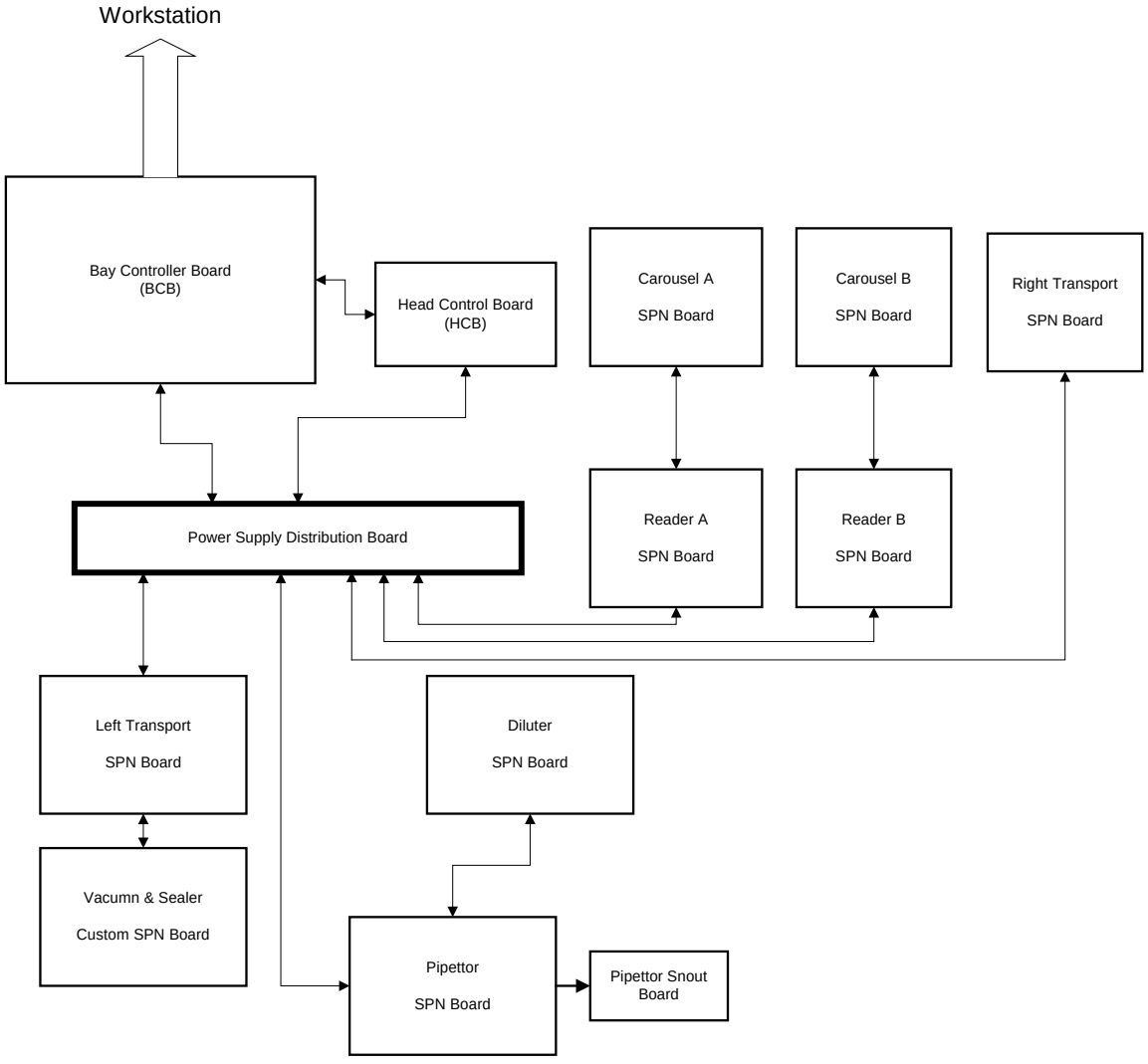


Figure 4-44 ***VITEK•2® XL*** PC Board Top Level Block Diagram

BCB Board

A Bay Controller Board (BCB) controls the optics, the communications to the workstation, the user interface, and serves as the master controller for the Sample Prep integrated Network (SPN) boards.

The firmware for the instrument is downloaded by way of the workstation during periodic updates to the flash memory on the BCB. This flash memory contains all the upper level processing for the instrument as well as sequentially buffering card data & alarm messages. The Bay Controller board also can capture a user-invoked backup of all the alignment settings.

The BCB is located under the top left instrument cover mounted to the underside of the cover. An EMI shield is mounted around the board serving as its outer cover.

Figure 4-45 shows the BCB location in the instrument.

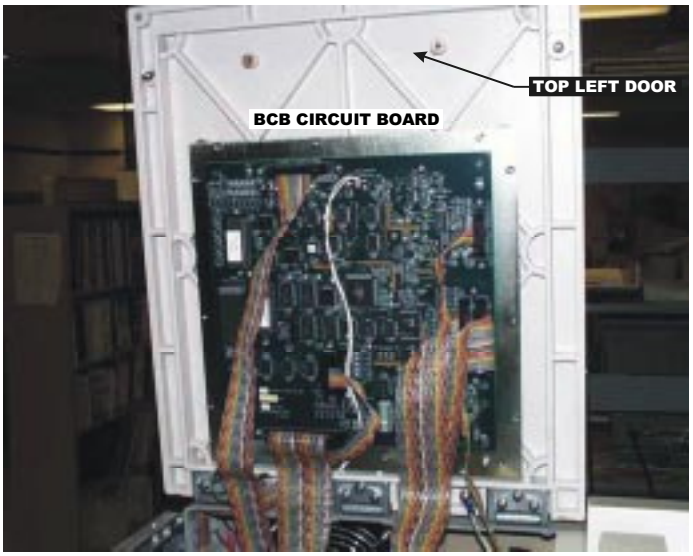


Figure 4-45 Bay Controller Board (BCB) Location (EMI Shield Removed)

The BCB is a Motorola MC68332 based computer board and is responsible for the following instrument functions:

- Controls for the optical systems and the associated data collection
- Non-volatile memory holding up to 2700 card hours of data
- User interface control
- Controls for card movement within the reader and incubator
- Laser bar code scanner
- Interface to the cassette button memory device
- Communications with the SCS including firmware updates
- Communications to the workstation computer
- Master control to the SPN network

Figure 4-46 and 4-47 show the instrument system electronics and the connections to the BCB.

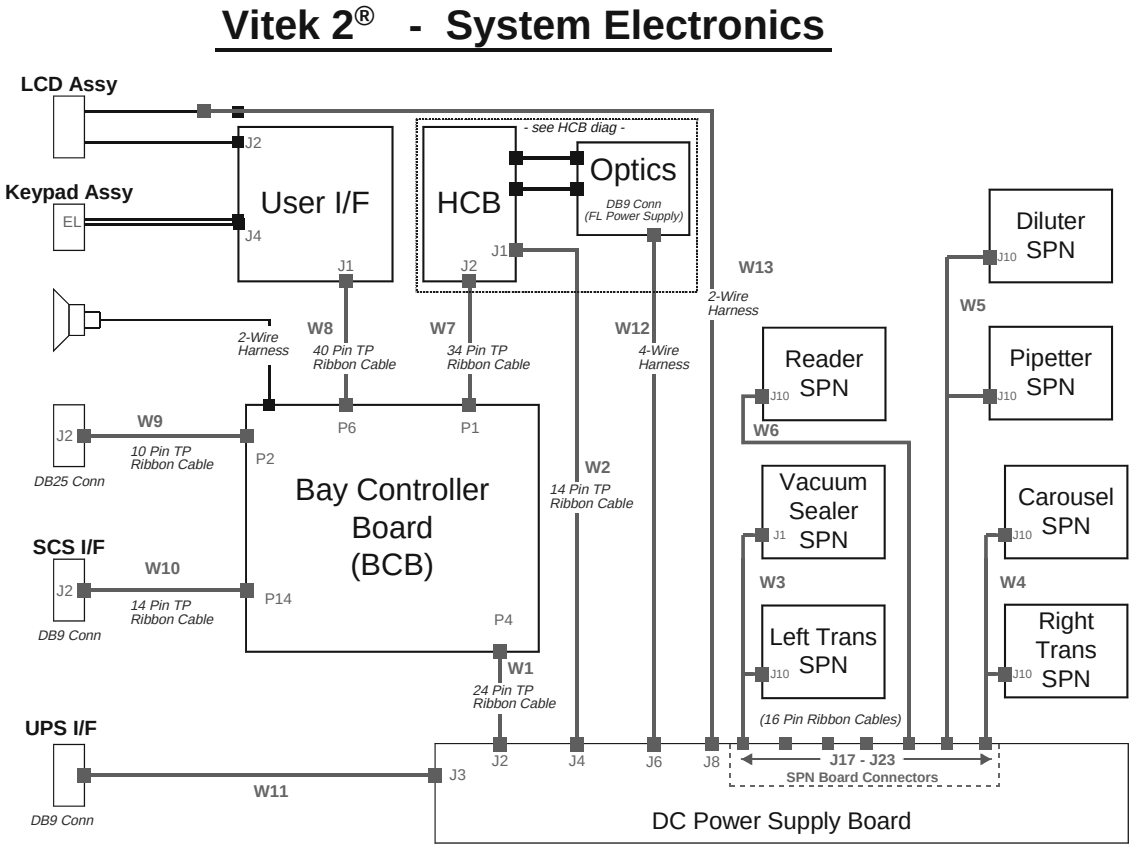


Figure 4-46 ***VITEK•2®*** System Electronics and BCB Connections

Vitek 2®XL - System Electronics

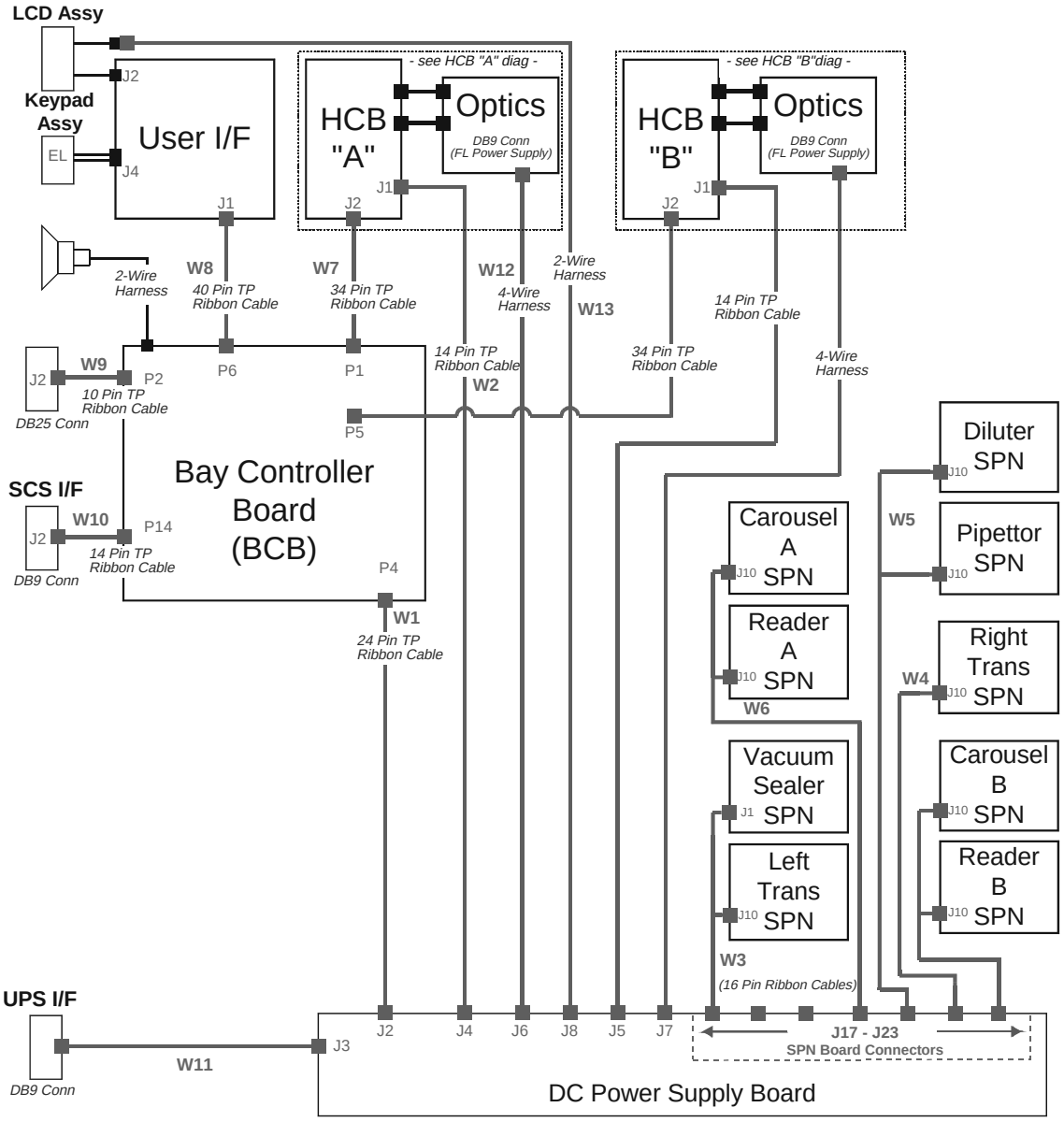


Figure 4-47 ***VITEK•2® XL*** System Electronics and BCB Connections

Figures 4-48 and 4-49 show the instrument jumper configurations.

HEADER	INSTALLED JUMPERS
HDR1	all
HDR2	none
HDR4	none
HDR5	all
HDR6	none
HDR7	1-2
HDR8	3-4 7-8
HDR 11	None
HDR 12	11-12 13-14
HDR13	speaker
HDR16	all
HDR19	none
HDR20	2-3
HDR21	2-3
P12	none

Figure 4-48 ***VITEK•2®*** BCB Jumper Configuration

HEADER	INSTALLED JUMPERS
HDR1	all
HDR2	none
HDR4	none
HDR5	all
HDR6	none
HDR7	1-2
HDR8	3-4 7-8 11-12
HDR11	none
HDR12	11-12 13-14
HDR13	speaker
HDR16	all
HDR19	none
HDR20	2-3
HDR21	2-3
P12	none

Figure 4-49 ***VITEK•2®*** **XL** BCB Jumper Configuration

Head Control Board

The Head Control Board (HCB) connected to the BCB serves as a analog I/O extension board for the reader drive belt motor, laser bar code reader, the button memory, transmittance optics and fluorescence optics. It also serves as the Analog to Digital (ADC) and Digital to Analog (DAC) converter for the transmittance optics.

The ***VITEK•2®*** includes one HCB and the ***VITEK•2® XL*** has two Head Control Boards.

Figure 4-50 and 4-51 shows block diagrams of the Head Control Board connections for the ***VITEK•2®*** & the ***VITEK•2® XL.***

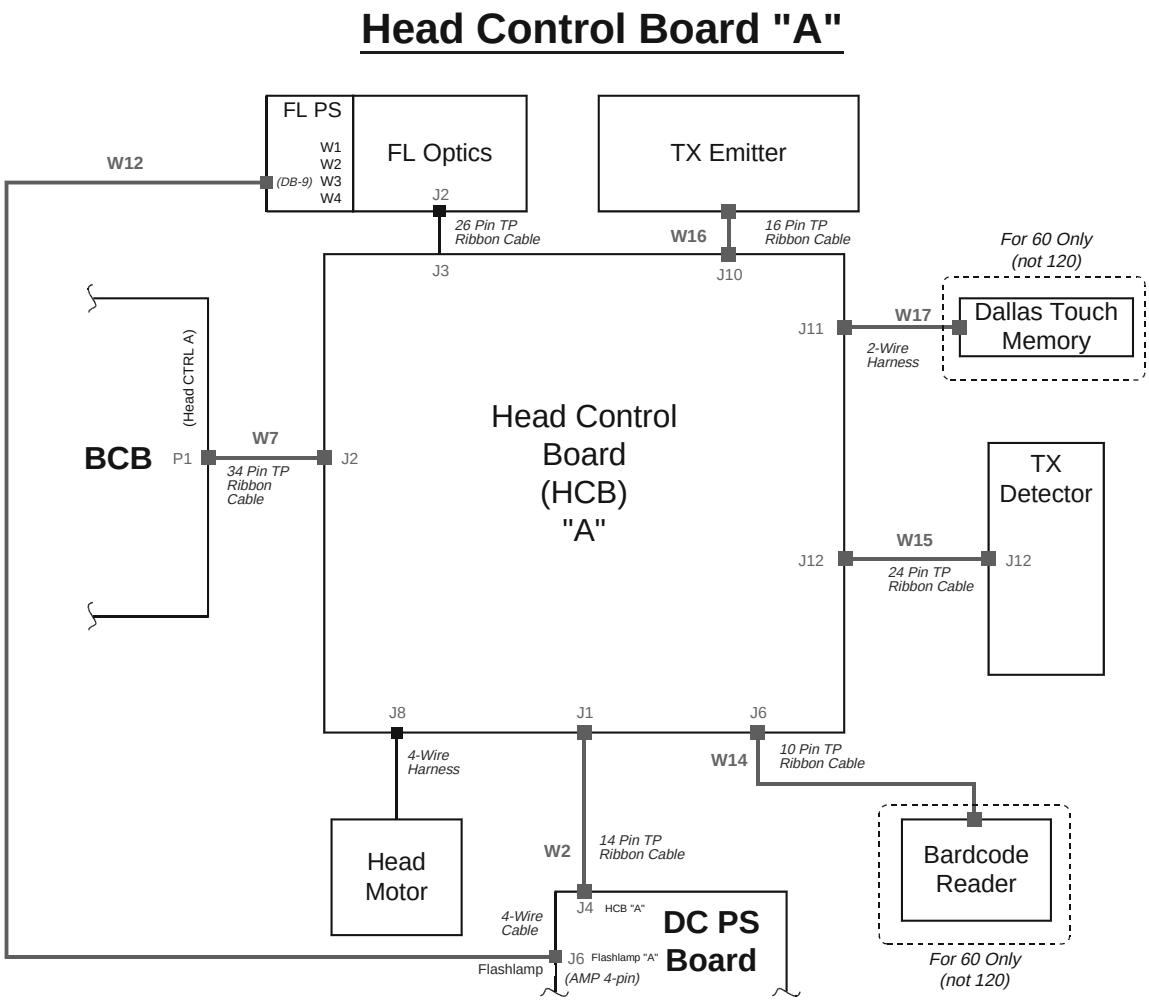


Figure 4-50 Head Control Board for ***VITEK•2®*** & ***VITEK•2® XL*** Section A

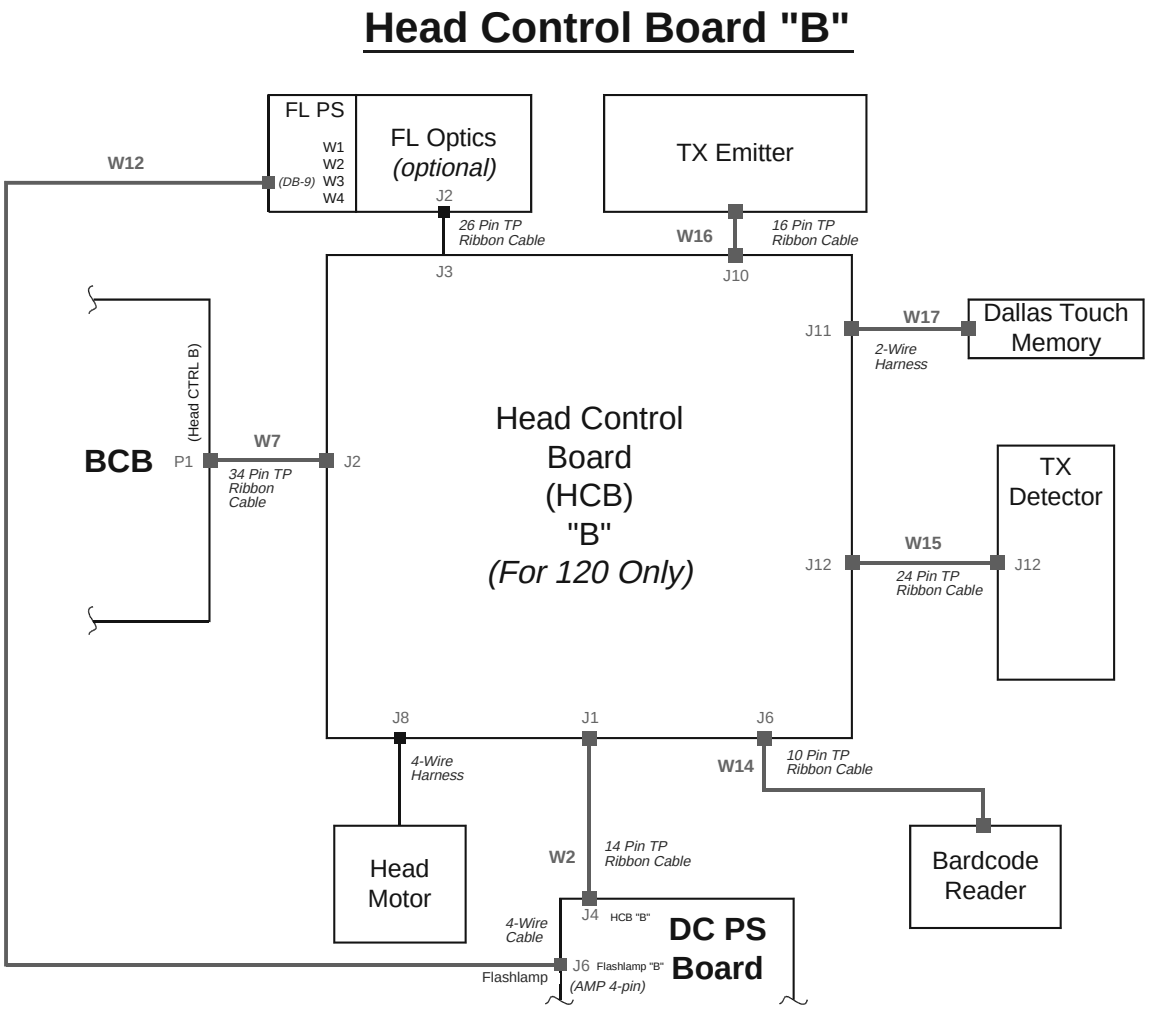


Figure 4-51 Head Control Board for ***VITEK•2® XL*** Section B

Sample Prep Node Board

The Sample Prep Node (SPN) board is a slave controller to the BCB. The SPN boards provide the remaining instrument interface and control functions. The SPN board is networked to the BCB as a slave via a serial interface.

SPN board architecture includes a Motorola MC68HC11 single PLCC firmware chip based computer responsible for the remaining functions relative to instrument processing. Each board location has a individual jumper configuration connection to determine the specific function or operation the board will perform.

The SPN board design and distributed control allow the boards to be placed close to the systems they are controlling. By means of the jumper connection, the board is specialized for the control of stepper motors, optical sensors, and general purpose I/O. The SPN board dedicated to the vacuum and sealing functions is the only unique SPN board in the instrument.

Figure 4-52 shows a typical SPN board mounted inside the instrument.

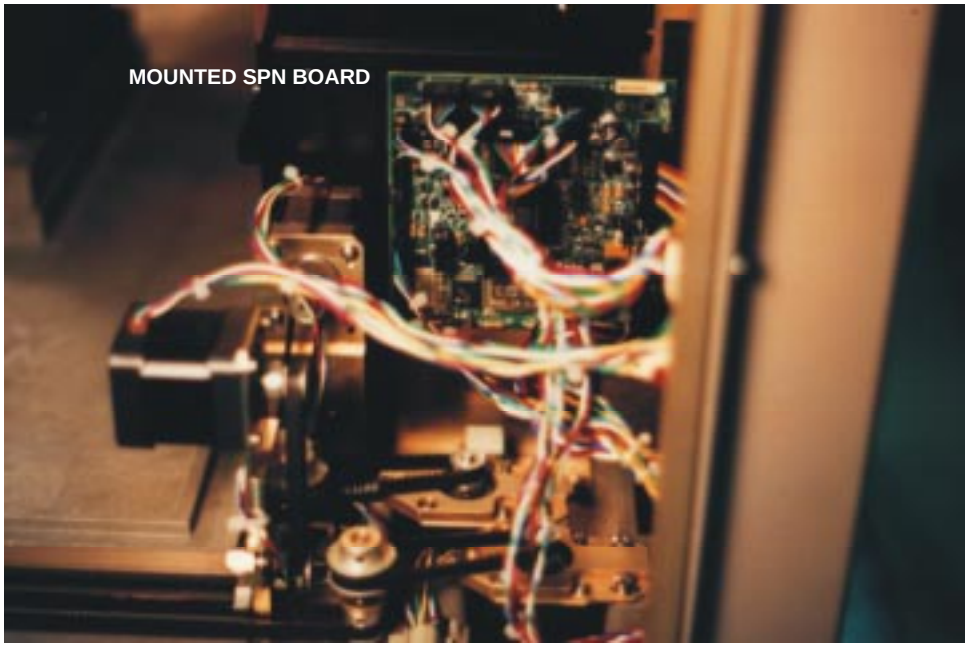


Figure 4-52 Instrument Mounted SPN Board

The ***VITEK•2®-60*** contains 7 SPN boards and the ***VITEK•2®-120*** contains 9 SPN boards. The SPN provides the following instrument interface and control functions:

- Left & Front Transport System
- Right & Back Transport System
- Diluter System
- Pipettor System
- Filler System/Card Seal System
- Reader System (two are included in the ***VITEK•2®-120)***
- Carousel System (two are included in the ***VITEK•2®-120)***

Tables 4-2 and 4-3 shows the Sample Prep Node board (SPN) jumper configurations for the ***VITEK•2®-60*** and ***VITEK•2®-120*** to setup specific SPN board operation.

Table 4-2 Sample Prep Node Board (SPN) for the ***VITEK•2®-60***

SPN BOARD P/N: 530704-1			
NODE	**INSTALLED JUMPERS**	**JP9 POSITION**	**DESCRIPTION**
1	---	---	<BCB>
2	JP2, JP9	1-2	Left Transport
3	JP3, JP9	1-2	Right Transport
4	JP4, JP9	1-2	Diluter
5	JP5, JP9	2-3	Pipettor
6	---	---	Vacuum / Sealer
7	JP7, JP9	1-2	Reader A
8	JP8, JP9	1-2	Carousel A

SPN BOARD P/N: 530704-2		
NODE	**INSTALLED JUMPERS**	**BOARD FUNCTION**
1	---	<BCB>
2	JP2	Left Transport
3	JP3	Right Transport
4	JP4	Diluter
5	JP5	Pipettor
6	---	Vacuum / Sealer
7	JP7	Reader A
8	JP8	Carousel A

Table 4-3 Sample Prep Node Board (SPN) for the ***VITEK•2®-120***

SPN BOARD P/N: 530704-2		
NODE	**INSTALLED JUMPERS**	**BOARD FUNCTION**
1	---	<BCB>
2	JP2	Left Transport
3	JP3	Right Transport
4	JP4	Diluter
5	JP5	Pipettor
6	---	Vacuum / Sealer
7	JP7	Reader A
8	JP8	Carousel A
9	JP1	Reader B
10	JP6	Carousel B

Figure 4-53 through Figure 4-65 shows the various PC board block diagrams of the SPN boards and the major components sensed or controlled by each board.

Left Transport SPN Board

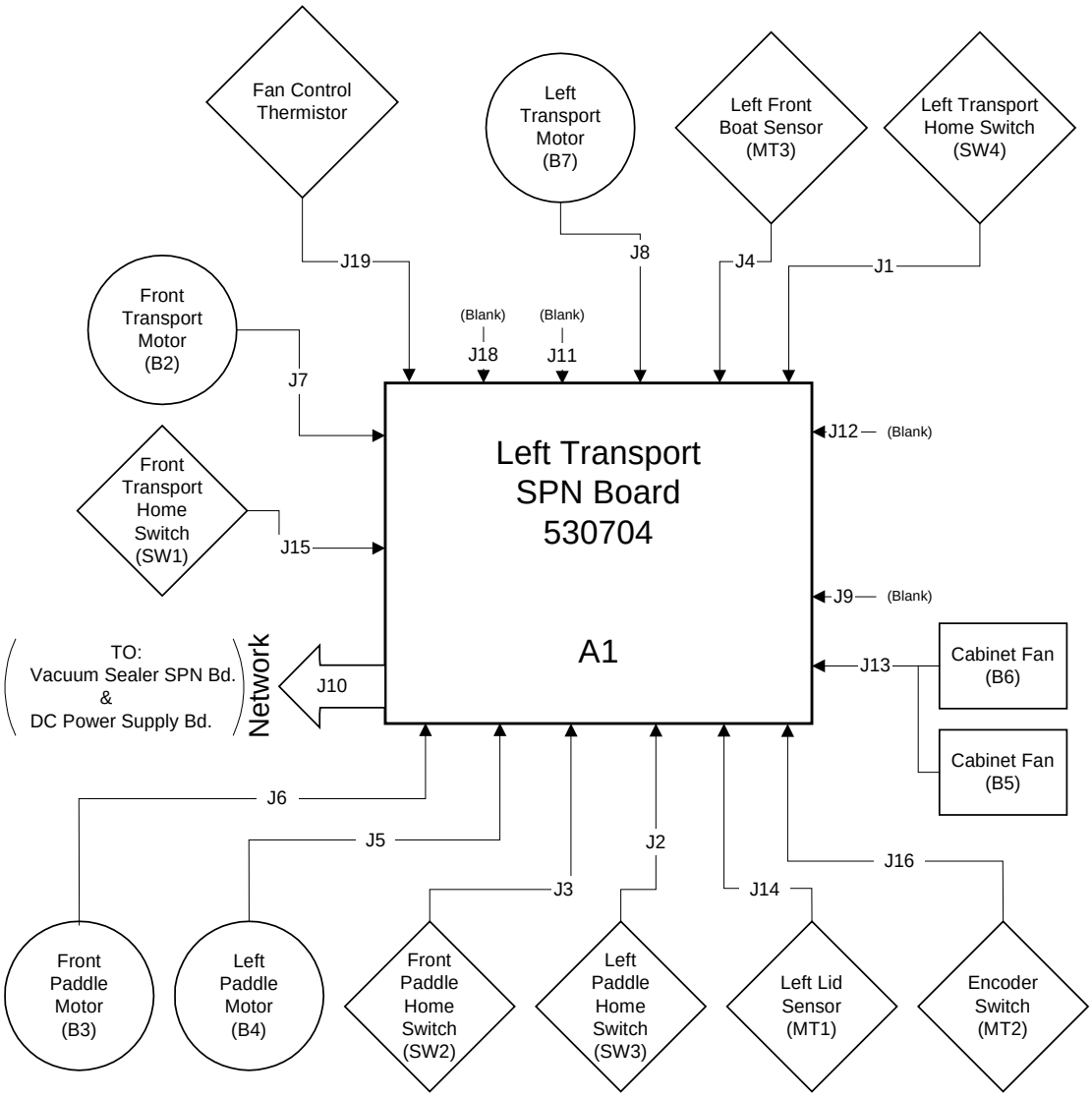


Figure 4-53 Left Transport SPN Board

Right Transport SPN Board

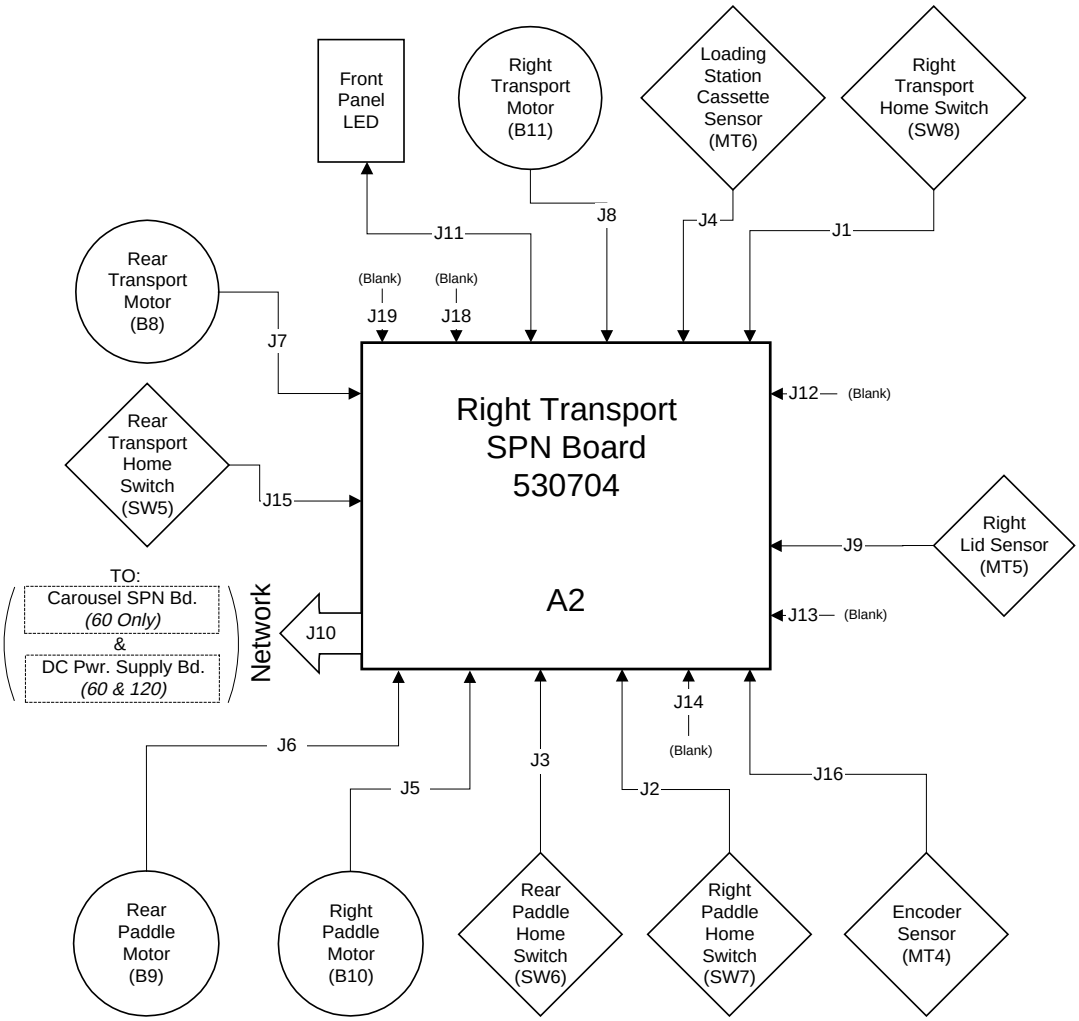


Figure 4-54 Right Transport SPN Board

Diluter SPN Board

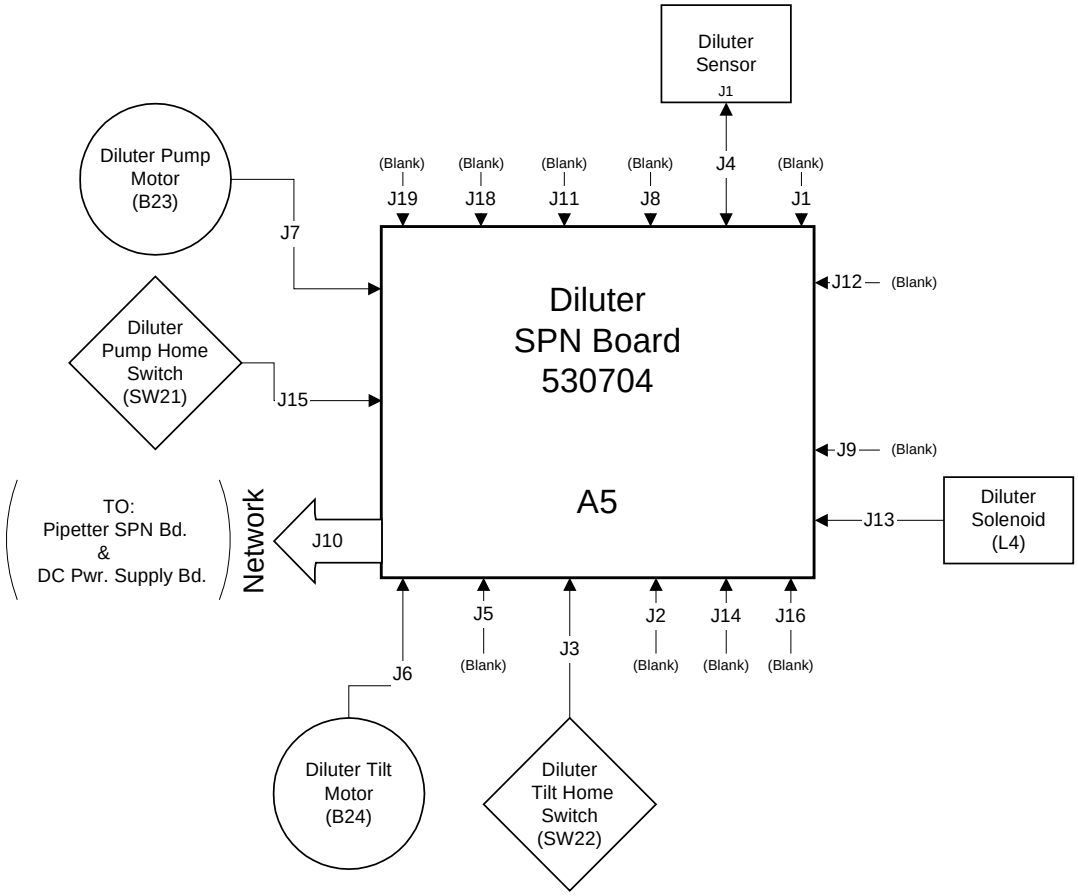


Figure 4-55 Diluter SPN Board

Pipettor SPN Board

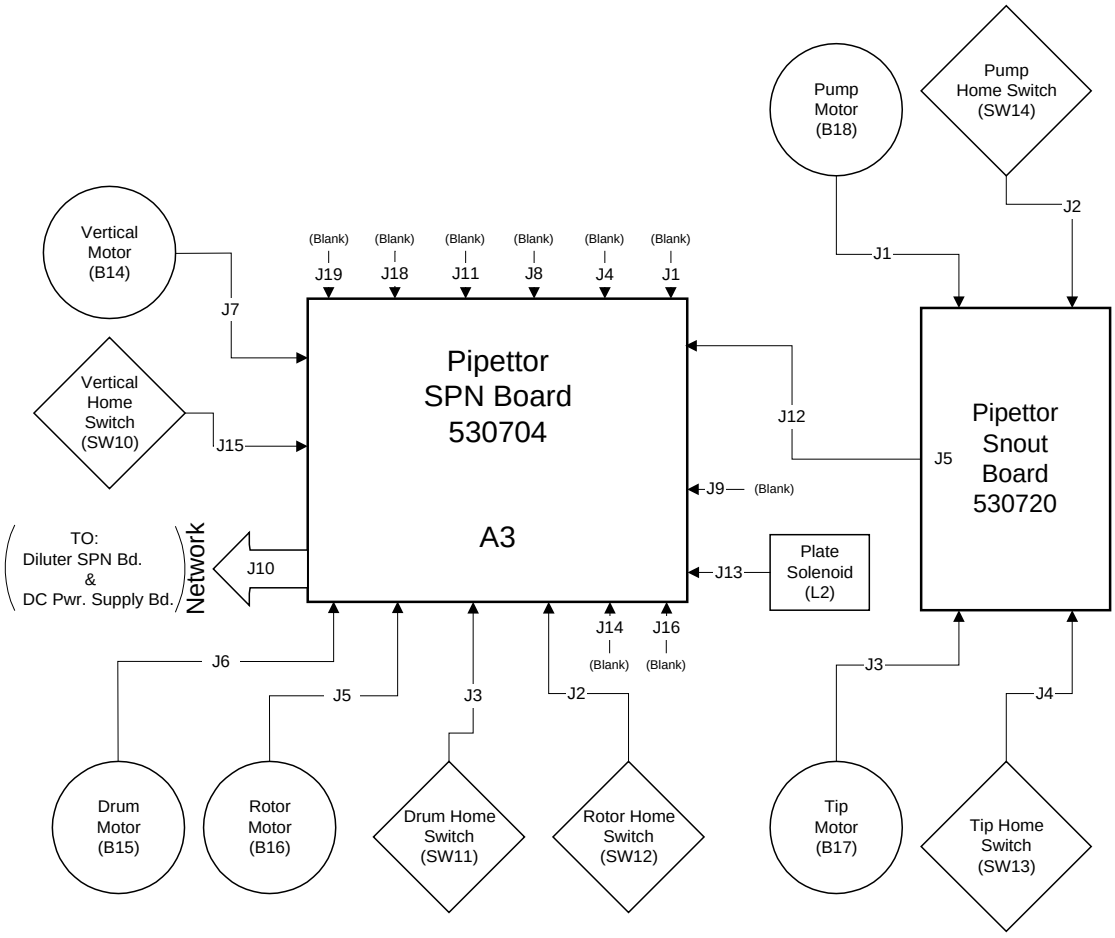


Figure 4-56 Pipettor SPN Board

Reader "A" SPN Board

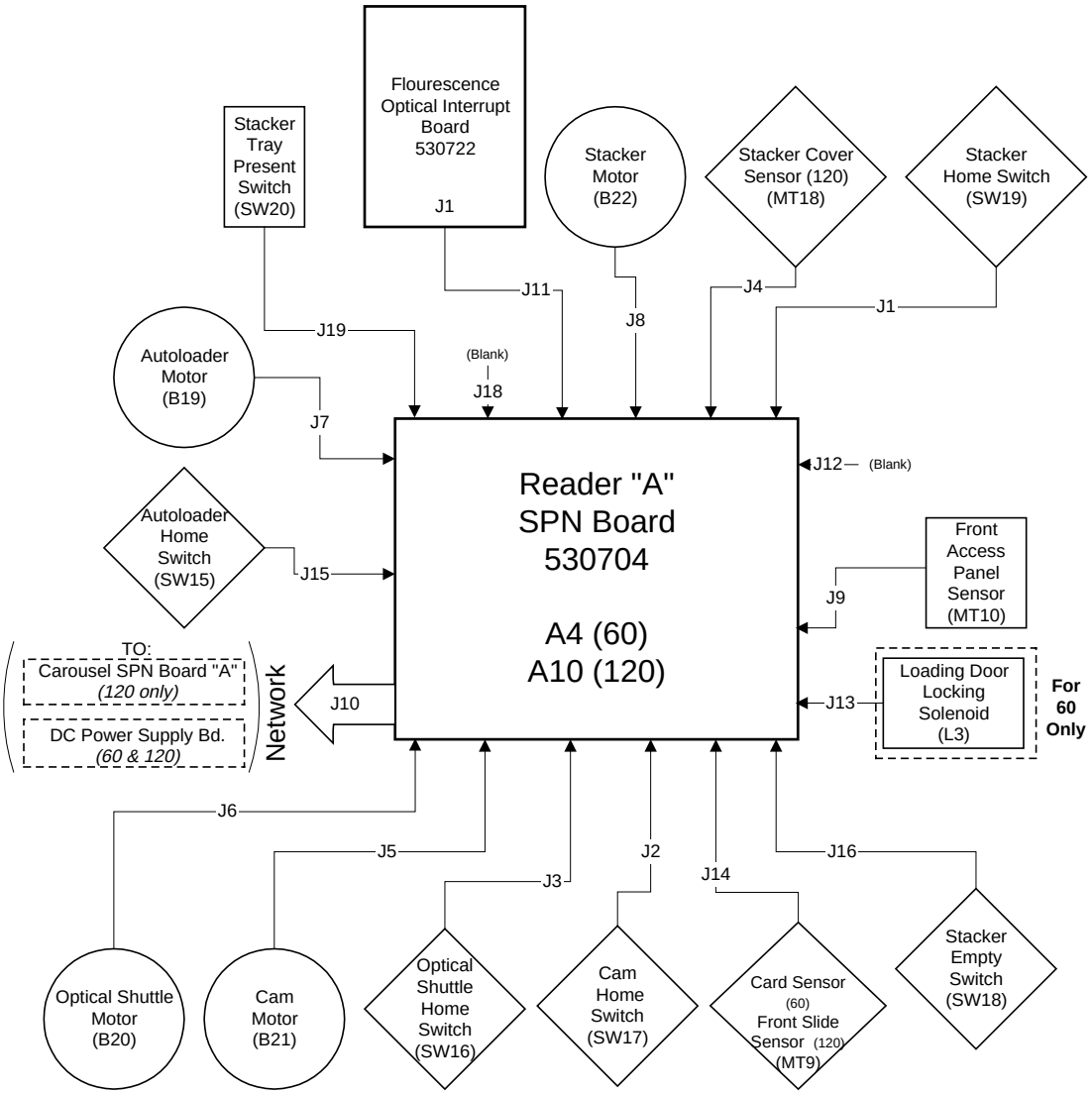


Figure 4-57 Reader SPN Board for ***VITEK•2®*** & ***VITEK•2® XL*** Section A

Reader "B" SPN Board (120 Only)

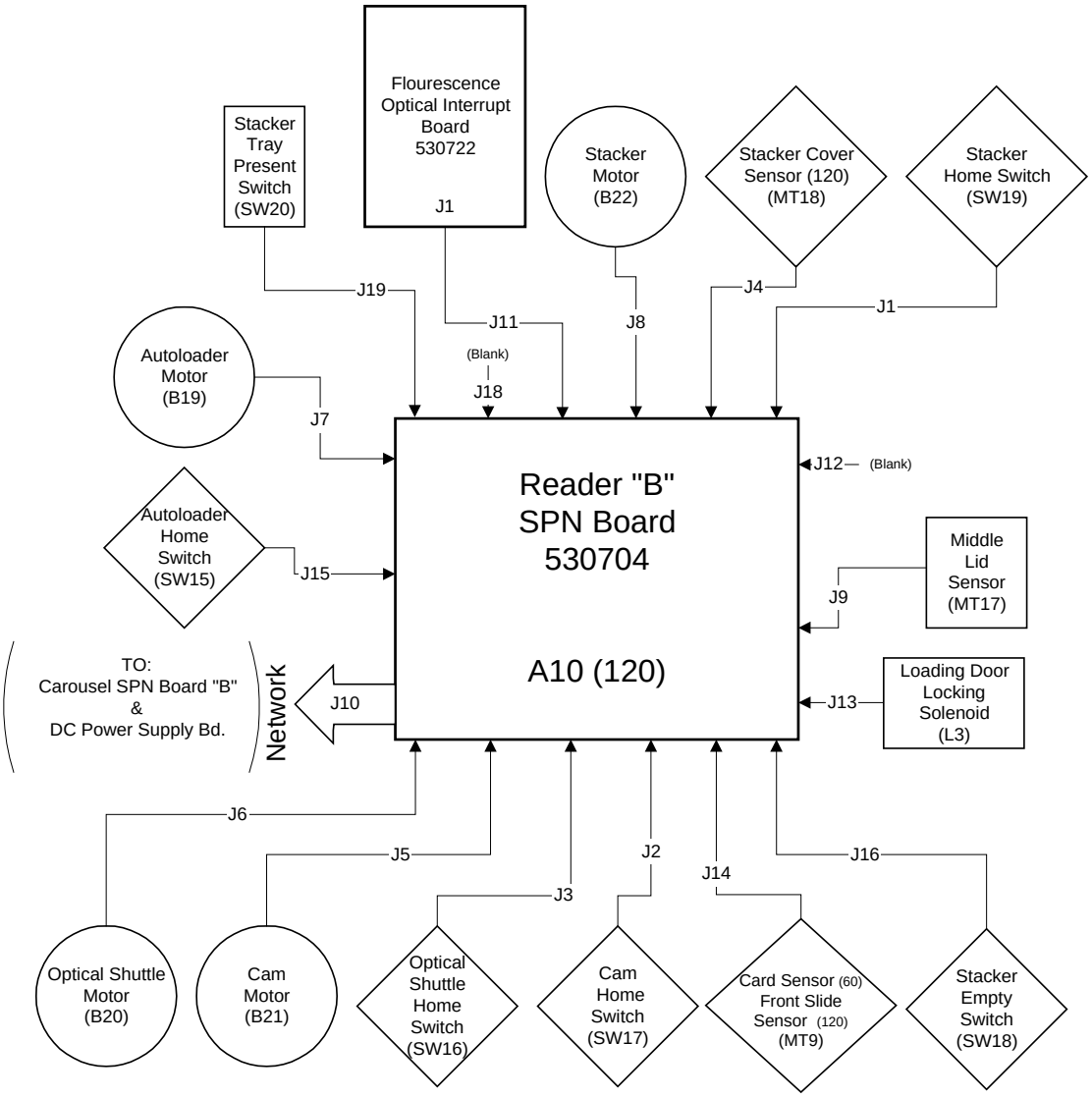


Figure 4-58 Reader SPN Board for ***VITEK•2® XL*** Section B

Carousel "A" SPN Board

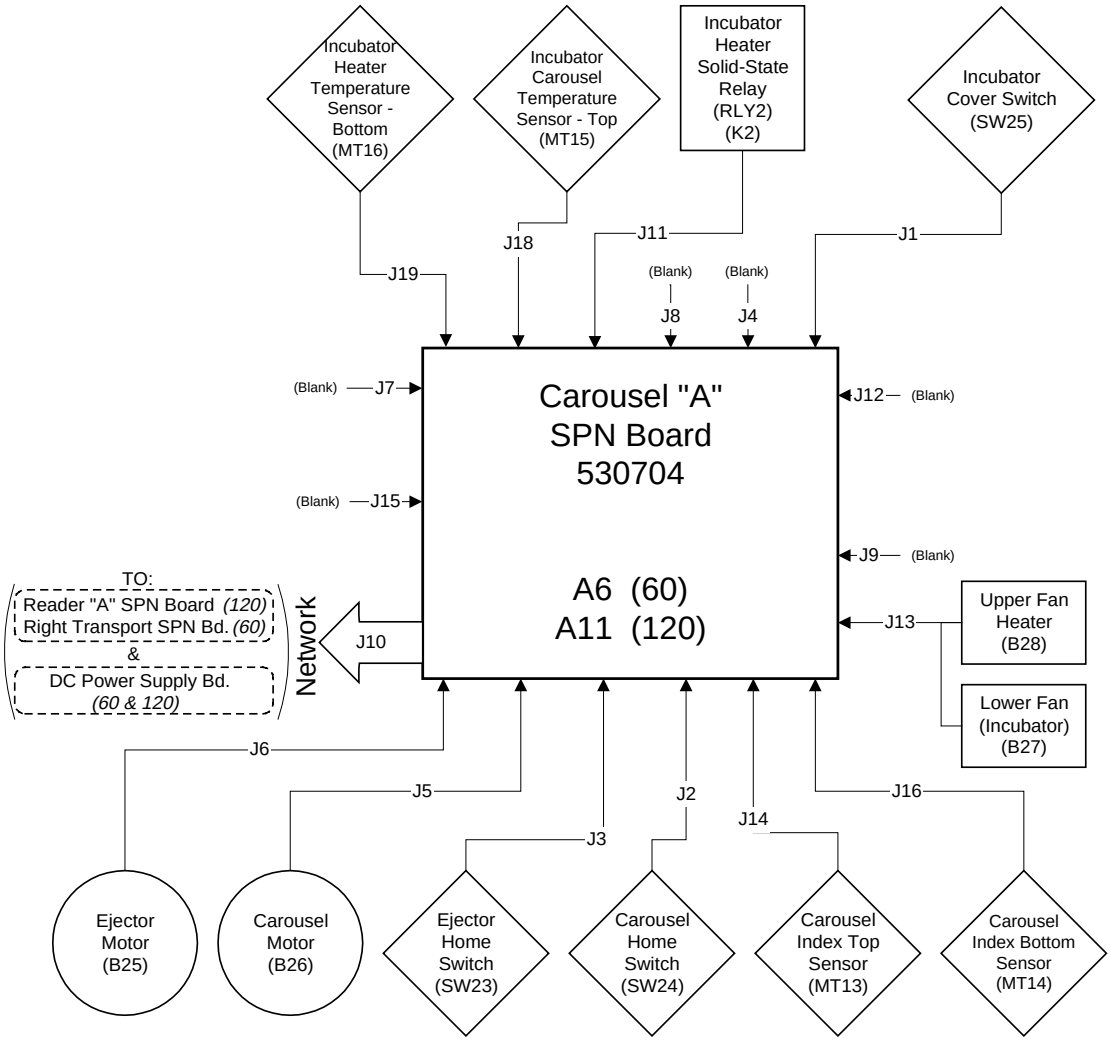


Figure 4-59 Carousel SPN Board for ***VITEK•2®*** & ***VITEK•2® XL*** Section A

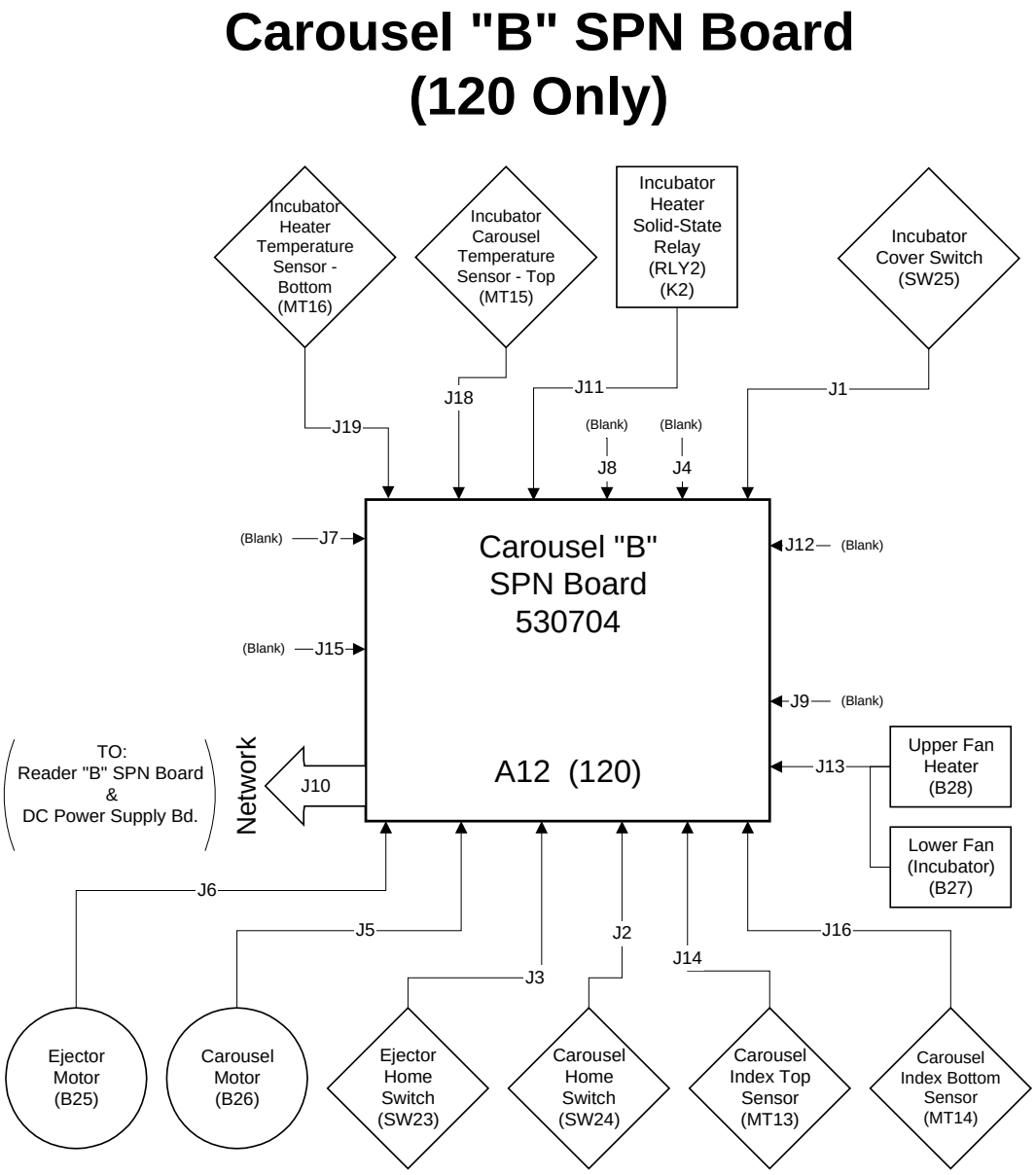


Figure 4-60 Reader SPN Board for ***VITEK•2® XL*** Section B

Vacuum Sealer Board

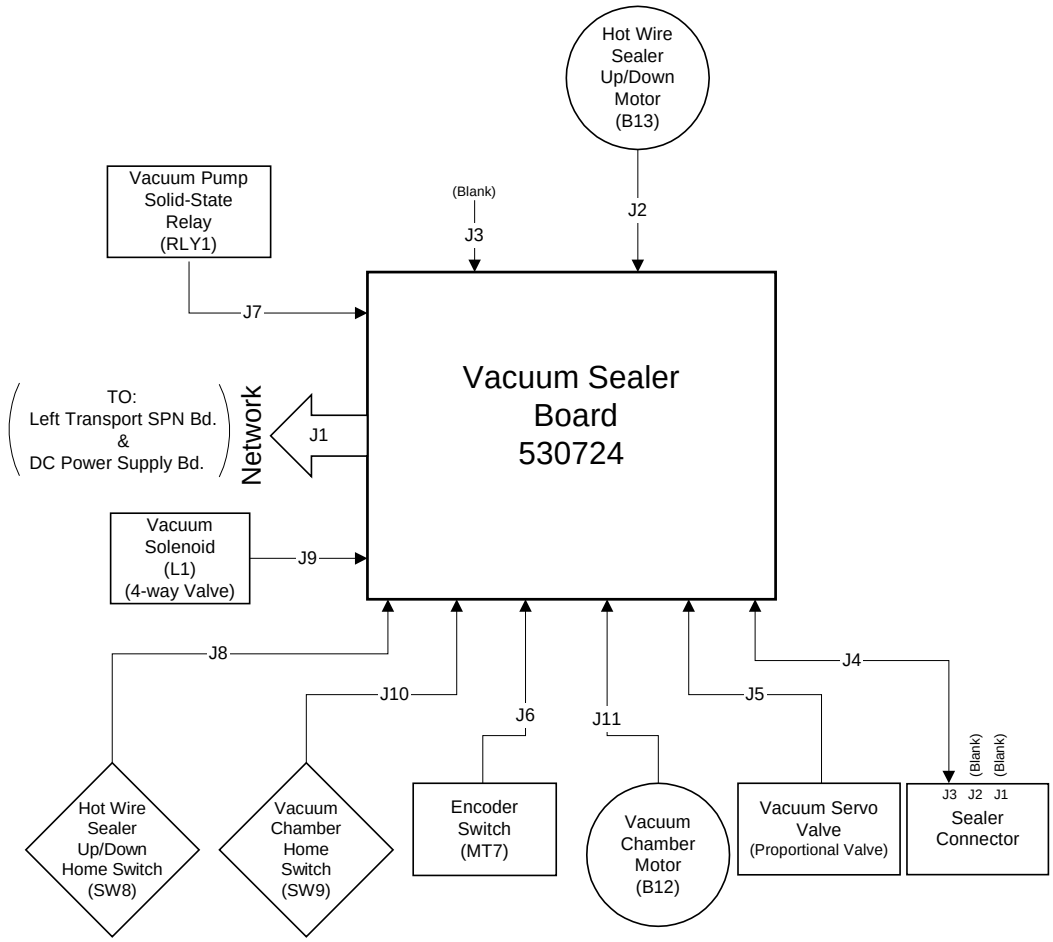


Figure 4-61 Vacuum Sealer Board

DC Power Supply Board

The DC Power Supply Board is a breakout board mounted on the inside left back plate of the instrument. All the SPN boards receive power from this board, along with the bay controller board, the head controller board(s), the fluorescence power supply(s), and the user interface back light.

Figure 4-62 shows the DC Power Supply Board and Figure 4-63 shows a layout diagram.

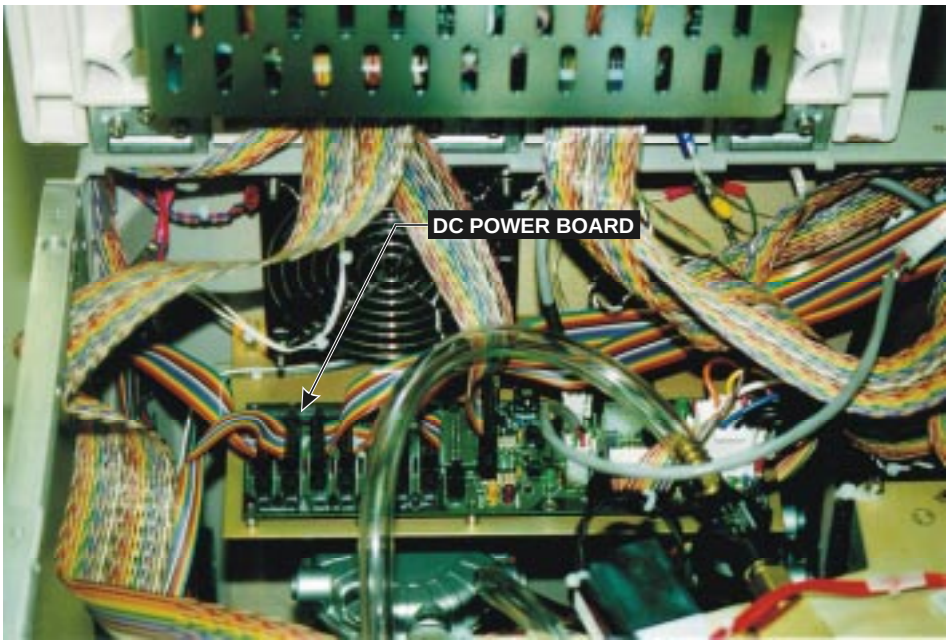


Figure 4-62 DC Power Supply Board

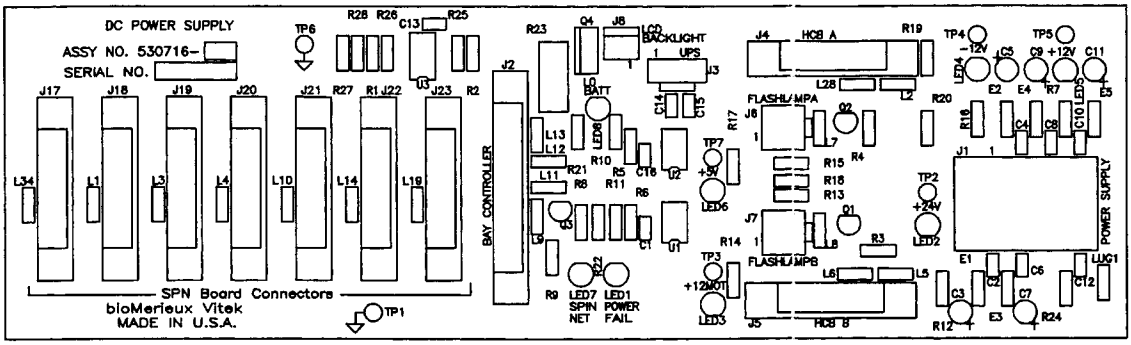


Figure 4-63 DC Power Supply Board Layout

Power Supply Drawer Assy.

The ***VITEK•2®*** instrument power drawer houses and supplies the required AC and DC voltages for instrument operation. The power supply drawer is located inside the base of the instrument, behind the flipdown bottom access door. (See Figure 4-64.)

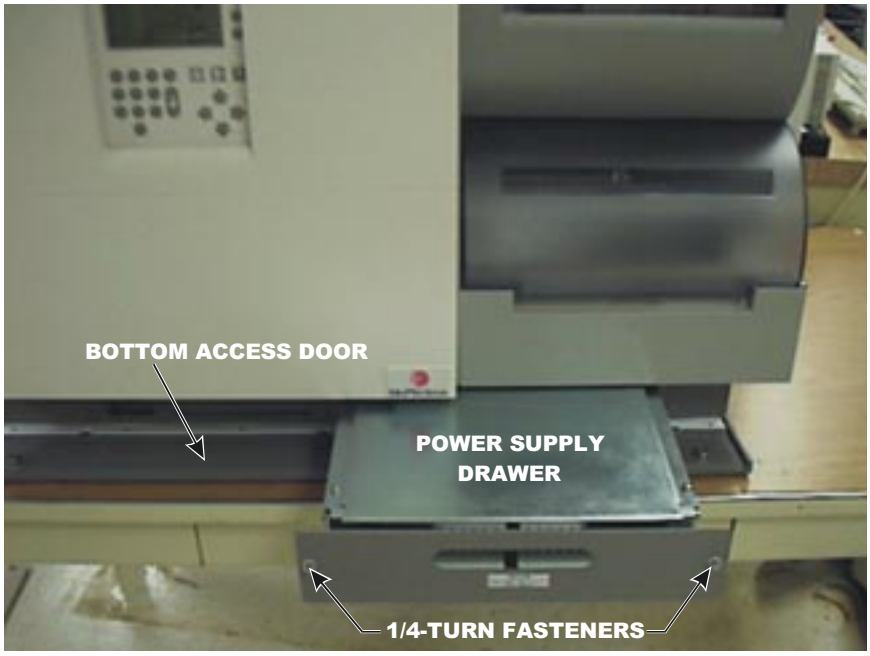


Figure 4-64 Power Supply Drawer Assembly

The power supply drawer houses the AC voltage distribution for the vacuum pump and incubator heater(s). The DC voltages feed the DC power distribution board.

Figure 4-65 shows the wiring diagram for the instrument power supply drawer.

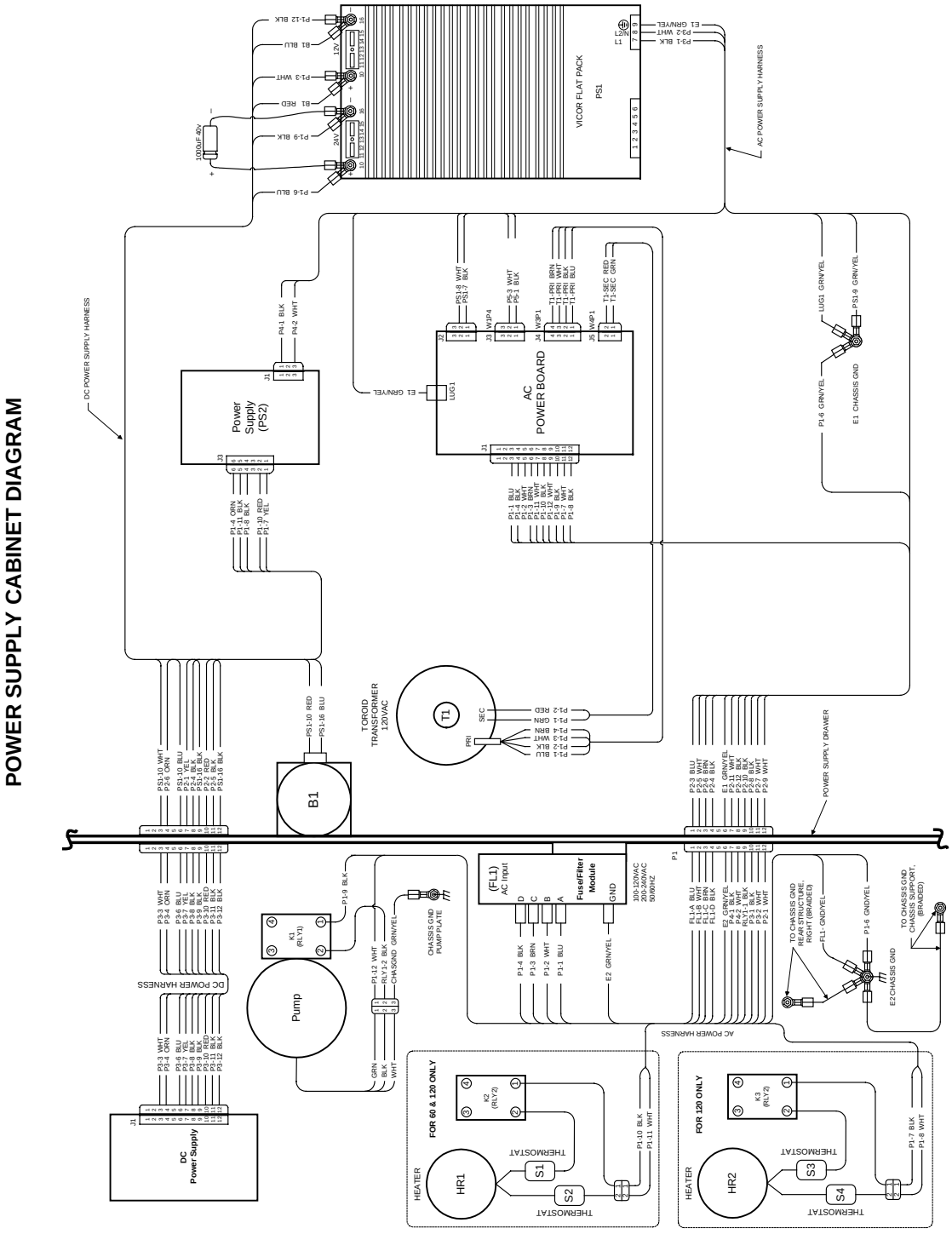


Figure 4-65 Power Supply Drawer Wiring Diagram

Chapter Five: **Component Installation**

This chapter contains the common field repair procedures for replacing various defective components of the ***VITEK•2***® integrated system instrument. Before performing any of these repair procedures, be sure you have used the troubleshooting procedures in Chapter Six of this manual to properly isolate the instrument's problems.

Ensure you *read* and *understand* the following warning information prior to performing any maintenance or entry into the instrument.

WARNING! Only Authorized ***VITEK•2***® instrument service technicians should attempt to perform any component installation or servicing of this instrument beyond normal operational and routine maintenance tasks. Contact bioMérieux for any additional information or procedural direction.

WARNING! Laser Bar Code Scanner is a laser light beam. Do not stare into the beam.

WARNING! The Fluorescence Optics power supply is a High Voltage source. The Optics is an Ultraviolet radiation source. All shields and filters must be in place prior to operation.

WARNING! The Fluorescence Optics has a high pressure flashlamp. To prevent injury, wear suitable protective devices such as safety glasses and gloves during disassembly.

WARNING! The Fluorescence Optics power supply is a High Voltage source. The Optics is an Ultraviolet radiation source. All shields and filters must be in place prior to operation.

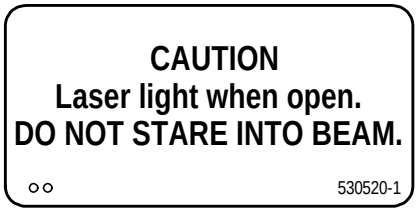
WARNING! The Sealer Station contains a wire that is heated during the sealing operation. The proper precautions should be taken.

Laser Bar Code Scanner Cautions and Warnings

The ***VITEK•2®*** contains a laser bar code scanner component to read the bar codes on the cards. Ensure you read and understand the following warning information prior to performing and maintenance or entry into the instrument.

Caution Labels:

- Located on the top-right side of the front access door and on the top-right access door behind the Waste Collection Tray(s). (The ***VITEK•2®-60*** has a third label behind the front access door.)



Laser Radiation Specifications:

- 660-680 nm
- 1 milliwatt maximum output

Caution Statements:

- Use of controls or adjustments of performance or procedures other than those specified herein may result in hazardous light exposure.
- All access doors and covers must remain closed when processing cards to avoid exposure to laser light.
- When making adjustments, do not stare into the laser beam.

Service Information:

- Follow all procedures, cautions, and warnings in this manual to avoid exposure to laser light.
- The bar code scanner requires no maintenance or service. If it fails, it must be replaced. Do not attempt to repair the bar code scanner.
- All protective housings must be left in place when operating the bar code scanner unless otherwise specified in this manual.
- Avoid exposure by not staring into the beam. Do not insert reflective items into the beam.

Repair Notes

NOTE: Before removing any circuit cards or internal components, place the main AC power switch and the UPS switches in the "OFF" position and disconnect the AC power cable from its power source.

NOTE: The circuit boards for the instrument are sensitive to static electricity. Wear a static wrist strap when handling circuit boards or electronic components. After removal of any circuit board, wrap it in anti-static material for storage or shipment.

NOTE: Before installing any new circuit board into the ***VITEK•2®*** instrument, check the switches and jumpers for correct settings by referring to current documentation or compare it to the circuit board being removed.

NOTE: When servicing instrument take caution not to contaminate disposables such as saline, pipette tips, and diluter tubes.

Voltage Test Points

Supplied voltages, shown in Table 5-1, should be tested at the listed test points for each of the circuit boards as indicated.

Table 5-1 Supplied Voltages

CIRCUIT BOARD TEST POINT DATA			
Test Point	**Signal**	**Voltage**	**Comments**
Bay Controller Board (BCB)			
TP1	VCC	+5V	
TP2	GND	0V	
TP3	GND	0V	
TP4	+24V	+24V	
TP5	GND	0V	
TP6	-RS232	-7.8V	Typical -7.8V, no specification on min/max
TP7	+RS232	+8.6V	Typical +8.6V, no specification on min/max
TP8	MGND	0V	
DC Power Supply Board			
TP1	GND	0V	
TP2	+24V	+24V	
TP3	+12MOT	+12V	
TP4	-12V	-12V	
TP5	+12V	+12V	
TP6	GND	0V	
TP7	+5V	+5V	
Head Control Board (HCB)			
TP1	-12V	-12V	
TP2	+12V	+12V	
TP3	GND	0V	
TP4	+5V	+5V	
TP6	GND	0V	
TP7	GND	0V	
TP8	DACOUT	0V to +5V	Variable output voltage, can be set by $HCB_DAC variable
User I/F Board			
TP1	+5V	+5V	
TP2	GND	0V	
TP3	GND	0V	
TP4	V2,LCD_BIAS	-12V to +24V	Variable, this voltage is set to V1 x 2
TP5	V1,LCD_BIAS	0V to 12V	Variable, set by LCD_BIAS_INC and LCD_BIAS_DEC
TP6	+5V	+5V	

Electrical Component and Circuit Board Replacements

This section of chapter five lists the recommended replacement and installation procedure steps and locations of the electrical and circuit board component parts when performing component and/or circuit board removal or replacement.

Power Switch Replacement

The ***VITEK•2***® instrument power switch is located on the left side rear area of the cabinet base. Power to the instrument is supplied from a power cord connected to a UPS. The UPS is plugged via the lab facilities' wall outlet.

Refer to Figure 5-1a for an illustration of the power switch front. Figure 5-1b shows the access cover which needs to be removed before gaining access to the power switch for removal.

Removal

1. Turn the switch to the off position and unplug the power cord.
2. Note the voltage on the power switch and with a flat blade screw drive, open the fuse cover.
3. Remove the fuse block and set aside.
4. Remove the rear access cover to expose the rear of the power switch.
5. Squeeze the plastic retainers or "tabs" on each side of the power switch holding the power switch to the panel base.
6. Gently remove the switch from the panel while feeding the power cable through the opening.
7. Tag and disconnect the wires attached to the power switch.

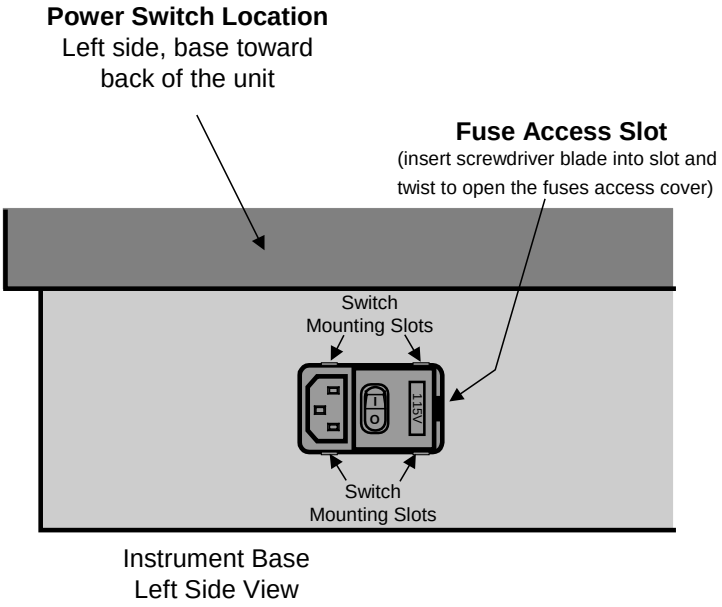

Power Switch Location
Left side, base toward back of the unit
Fuse Access Slot
(insert screwdriver blade into slot and twist to open the fuses access cover)
Switch Mounting Slots
115V
Switch Mounting Slots
Instrument Base
Left Side View

Figure 5-1a Power Switch Replacement

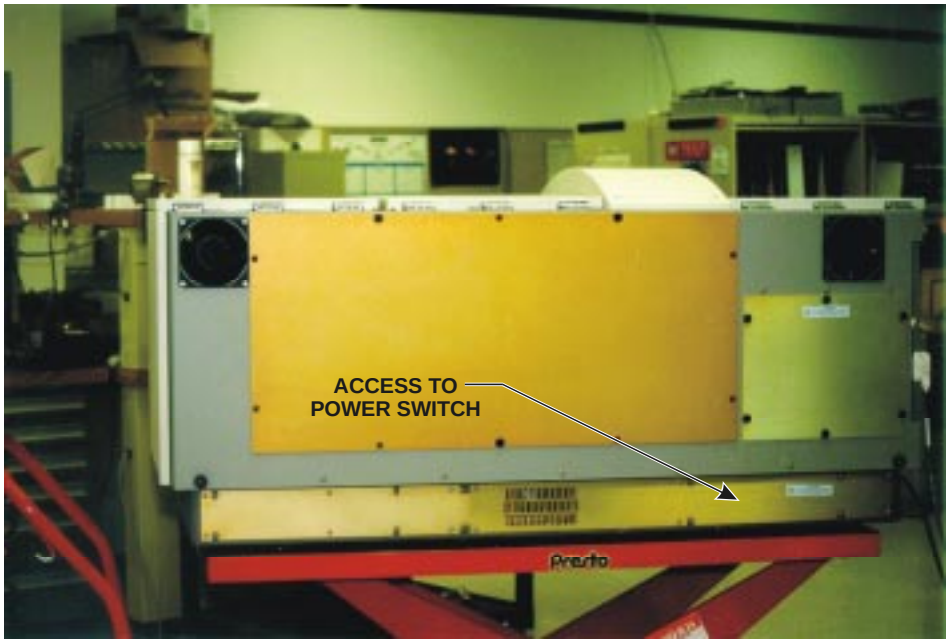


Figure 5-1b Access to Power Switch

Installation

1. Reconnect the wires to the power switch as tagged.
2. Gently feed the wiring cable and the power switch into front of the base cabinet mounting opening making sure to position the power switch the same as the one removed.
3. Push firmly on the power switch until the plastic retainer tabs on the back of the circuit breaker snap firmly into place.
4. Install the fuse block in the power switch housing for the correct voltage as noted before. Close fuse cover.
5. Reconnect the power cable to the instrument's power connection plug.
6. Verify instrument is ready to be started, turn the power switch ON, and verify instrument operation.

Power Switch Fuse Replacement

Refer to Figure 5-2 for the Power Switch Fuses location.

Removal

1. Turn the instrument power switch off and unplug power cord from the instrument.
2. Note the voltage setting on the fuse block and with a flat blade screwdriver, pry open the access over for the fuses.
3. Note the position of the fuse block and pull out the fuse block. Remove defective fuse.

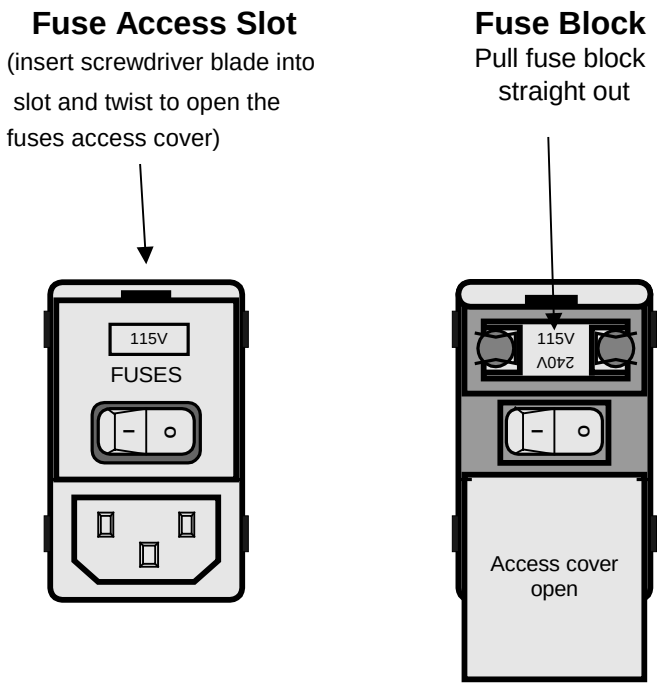


Figure 5-2 Main AC Power Switch Fuse Replacement

Installation

1. Replace fuse in the fuse block. (The Power Switch should include one MDA, 5A, 250V fuse for the 115V setting and two GDC, 5A, 250V fuses for the 230V setting.)
2. Install fuse block into the power switch housing as noted from the removal.
3. Close access cover over the fuse block.
4. Plug the power cord into the instrument power connection plug.
5. Ensure the instrument is ready to be started, turn switch ON, and verify system operation.

Power Supply Drawer Assembly

This replacement procedure will be common to all the components contained inside the Power Supply Drawer Assembly. (See Figure 5-3.)

WARNING! Power supply is heavy, support the cabinet firmly at all times while handling the power supply cabinet. Power supply cabinet weighs 14 kg. (30 lbs.)

NOTE: The power supply cabinet can be exchanged as a complete unit or individual parts can be ordered and replaced.

Removal

1. Open the base cabinet door to access the power supply cabinet front.
2. Rotate the 1/4-turn fasteners on the power supply cabinet located on the front base section of the instrument counter-clockwise. (Figure 5-3)
3. Pull and slide the power supply cabinet out of the base section of the instrument.
4. Replace non-functioning part or entire Power Supply Drawer Assembly (Figure 5-4).

NOTE: If replacing entire assembly, ship the old one back to bioMérieux for repair.

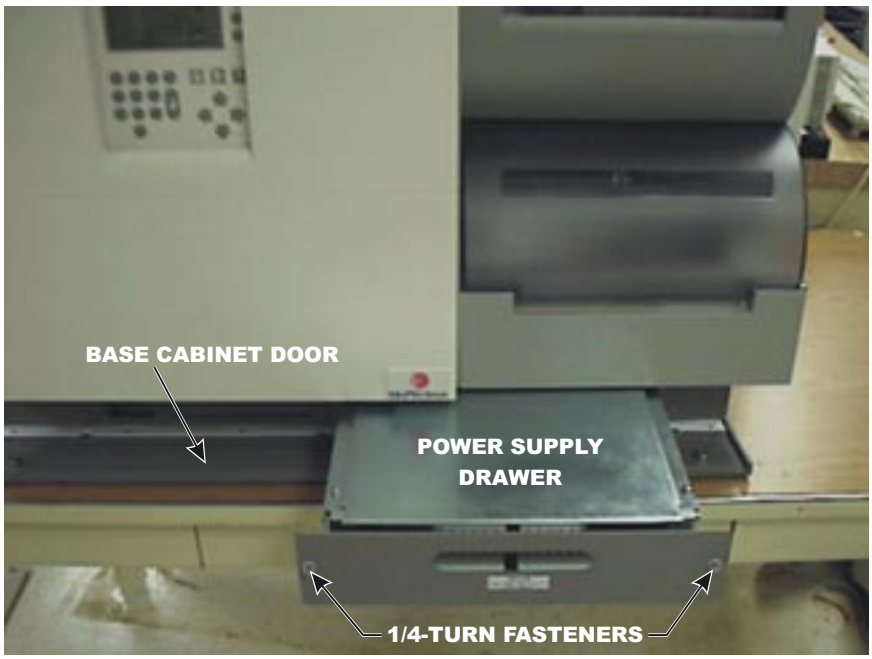


Figure 5-3 Power Supply Drawer Assembly

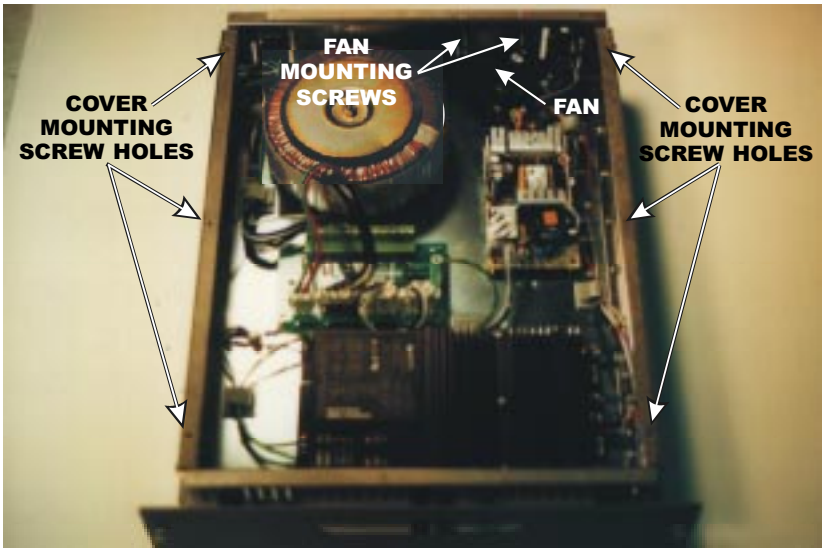


Figure 5-4 Power Supply Drawer Assembly & Internal Components

Installation

1. Place the power supply base in the base slot and slide the Power Supply Drawer Assembly fully in the base until it stops flush on the front base. Tighten the 1/4 turn fasteners to secure the power supply in place.
2. Ensure the instrument is ready to turn ON and verify voltages as necessary per Table 5-1.
3. Shut the base cabinet access door.

Solid State Relay Replacement

There is more than one solid state relay installed in the instrument (2-60 unit, 3-120 unit). One for each Reader Incubator and one for the Vacuum Pump. This procedure will be common to all the solid state relays installed in the instrument. The access to the vacuum pump solid state relay is from the rear panel of the instrument. Access to the incubator heater solid state relay is gained by first removing the rear panel of the instrument and then by removing the incubator chamber rear access cover. Figure 5-5 shows a typical solid state relay.

Removal

1. Remove panels to access the solid state relay for replacement.
2. Remove the relay shield by placing a flat tip screw driver between shield and relay then prying the shield off.
3. Disconnect and tag all wires going to the relay.
4. Note the relay position and remove the screws and washer from each end of the relay.
5. Remove the relay and discard.

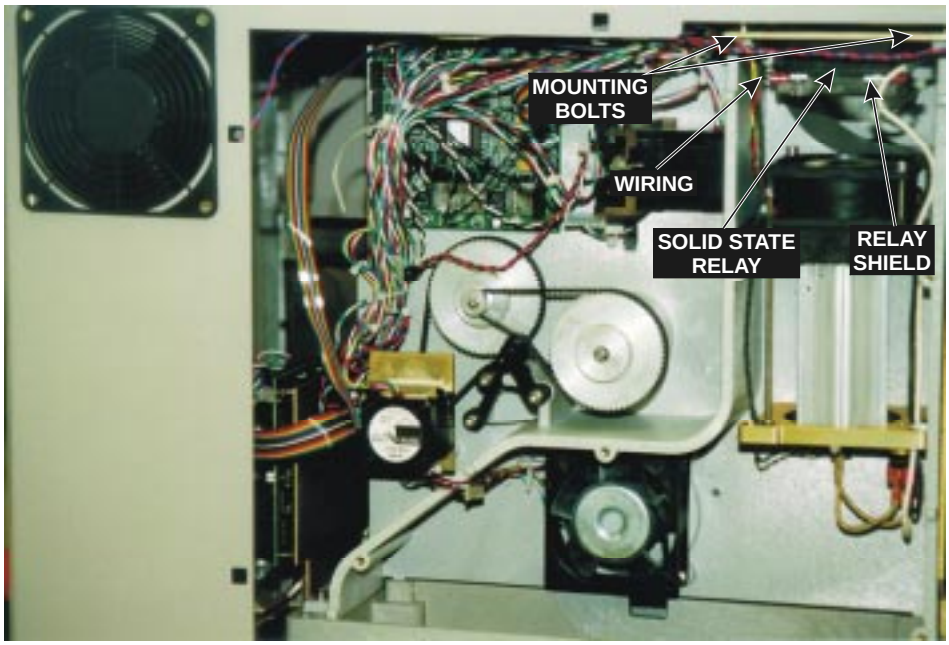


Figure 5-5 Solid State Relay Replacement

Installation

1. Place the relay into position on mounting plate as noted from removal.
2. Install washers and screws to attach relay to mounting plate.
3. Reconnect the tagged wires back to the proper points on the relay.
4. Place relay shield over the relay.
5. Install the access panels removed for replacement of the relay.
6. Ensure instrument is ready to turn ON and verify operation. (See Table 5-1 for voltage test point information.)

Bay Controller Board (BCB) Replacement

Refer to Figure 5-6 for BCB Circuit Board Location.

Removal

1. Open the top left door of the instrument to access the BCB circuit board.
2. Remove Bay Controller EMI Cover.
3. Disconnect and tag all cables from the BCB circuit board.
4. Note the mounting position of the BCB circuit board on the mounting plate.
5. Using a flat tip screw drivers, gently pry the board from the standoffs holding the board in place and remove the board from the instrument. (Be sure not to damage the board.)

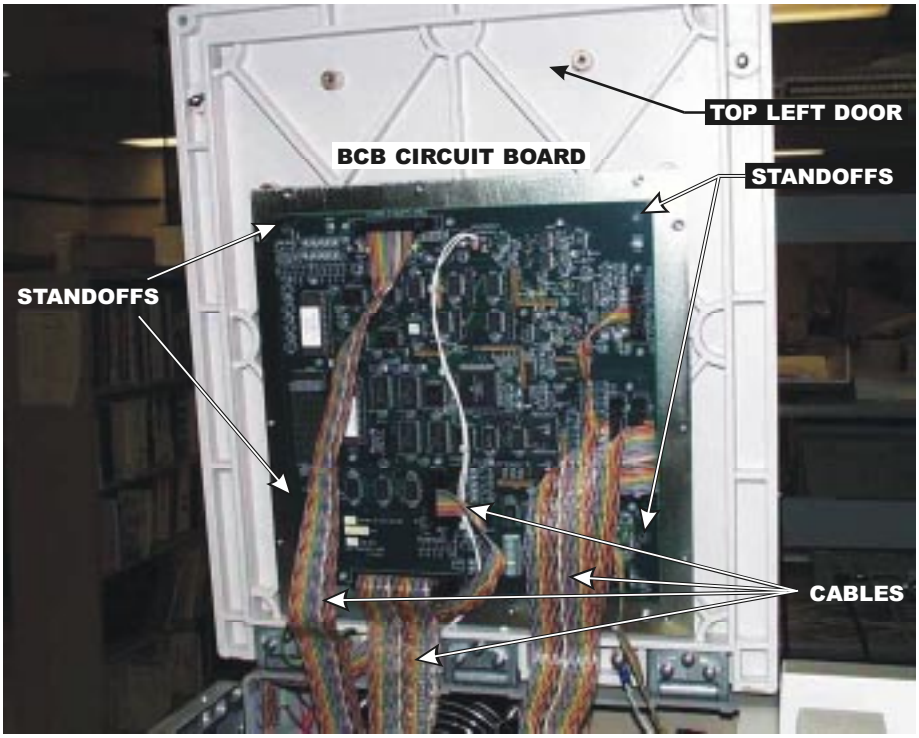


Figure 5-6 BCB Circuit Board Replacement (cover removed)

Installation

1. Compare the replacement board with the old board for any jumper or switch configuration and make any adjustments. Also confirm boot firmware has latest version.
2. Place the new BCB into the noted position from removal of the old board and gently press the board on the standoffs.
3. Reconnect the cables to the BCB circuit board connectors that were previously removed.
4. Ensure the instrument is ready to turn ON and verify board is working. (See Table 5-1 for voltage test point information.)
5. From the diagnostic terminal, confirm the following are displayed during the instrument initialization:

   (NOTE: If the instrument has completed initialization before the screen could be reviewed, use **FLASH_LOG_BOOT** command.)

   "BOOT Boat Management System is OK"
   "BOOT SEQ TASK 60 is OK"
   "BOOT FLASH Data File Verified"
   (If this is a 120, ensure "BOOT SEQ TASK 120 is OK".)

6. From the diagnostic terminal, type **save_alignment**. (This command uploads the current alignments from the SPN boards to the BCB board.)
7. From the Command Terminal of the Work Station, at the dms> prompt type **vt2setup** and press **ENTER**.
   a) In ***VITEK•2®*** Setup type **2** and press **ENTER** for Instrument Association. Instrument Association has 4 columns. The first column header is labeled #. This label is the identification for the buttons on the ***VITEK•2®*** User Interface. The second column is labeled Instrument. This is the corresponding internal serial number of the Bay Controller Board on each ***VITEK•2®***. The third is labeled Name. This is the instrument name given to the ***VITEK•2®*** by the operator. The last is labeled Device. This is referencing which serial port the data cables are hooked.
   b) First type the internal serial number of the removed Bay Controller Board and press **ENTER**. This can be identified by the Name that the ***VITEK•2®*** has been given. Note the corresponding "#" and the old internal BCB serial number.
   c) Type **0** and press **ENTER** so the old BCB serial number becomes Undefined. **Updating database** will appear for a few moments.
   d) Type the corresponding internal serial number for the new BCB and press **ENTER**. This can be identified by the Device.
   e) Finally type the Number that the ***VITEK•2®*** should be associated with and press **ENTER**. Refer to your note made in step b. **Updating database** will appear for a few moments.
   f) Press **q ENTER** to exit from Instrument Association and press **q ENTER** to exit from ***VITEK•2®*** Setup.

8. From the Diagnostics display of the corresponding ***VITEK•2®*** type **file_request BCB_Firmware.mot** and press **ENTER**. (NOTE: This command updates the BCB firmware and is case sensitive.) Uploading the flash from the Work Station to ***VITEK•2®*** will take 35 - 40 minutes.
9. From the Diagnostic prompt type **fix_spn_params** and press **ENTER**. This updates the SPN parameters as determined by the BCB firmware.
10. From the diagnostic prompt type **FILE_REQUEST** followed by the old BCB serial number noted in step 7b and **.CFG**. Press **ENTER**.

    Example: **FILE_REQUEST 00000388740A.CFG**

    (This command updates Fluorescence Calibration, instrument computations and user interface selections from a 24 hour backup residing on the work station.)

DC Power Supply Board Replacement

Refer to Figure 5-7 for the location of the DC Power Supply Board.

Removal

1. Open the top left door of the instrument to access the DC Power Supply Board.
2. Disconnect and tag all cables from the DC Power Supply Board.
3. Using a flat tip screwdriver, gently pry the board off of the standoffs holding the board in place and remove the board from the instrument. (Be sure not to damage the board.)

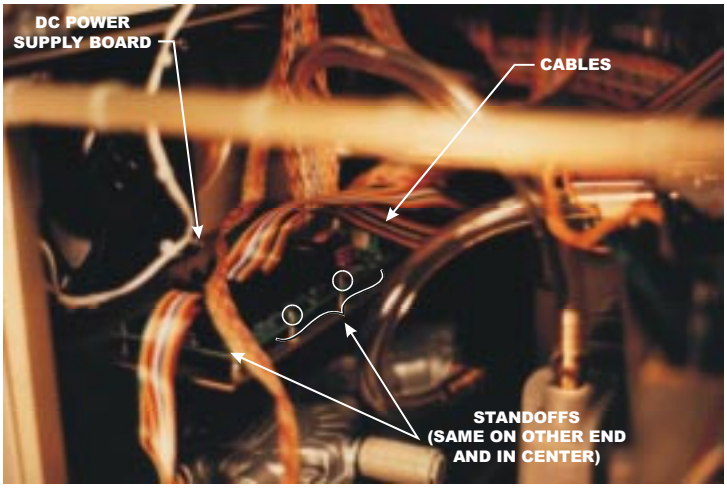


Figure 5-7 DC Power Supply Board Replacement

Installation

1. Compare the replacement board with the old board.
2. Place the new DC Power Supply Board into position and install on to the standoffs.
3. Reconnect the cables to the DC Power Supply Board.
4. Ensure the instrument is ready to turn ON and verify board is working. (See Table 5-1 for voltage test point information.)

Head Control Board (HCB) Replacement

Refer to Figure 5-8 for the location of the HCB circuit board.

Removal

1. Open the instrument top covers. Disconnect the drain tube from the Diluter Cover and then unscrew and move the Diluter Cover (including the saline bag), to access the HCB board.
2. Tag and disconnect the cables attached to the HCB board.
3. Note the mounting position of the board and with a flat tip screwdriver, gently pry the board from the standoffs holding the HCB board into place. (Be sure not to damage the board.)
4. Remove the HCB Board.

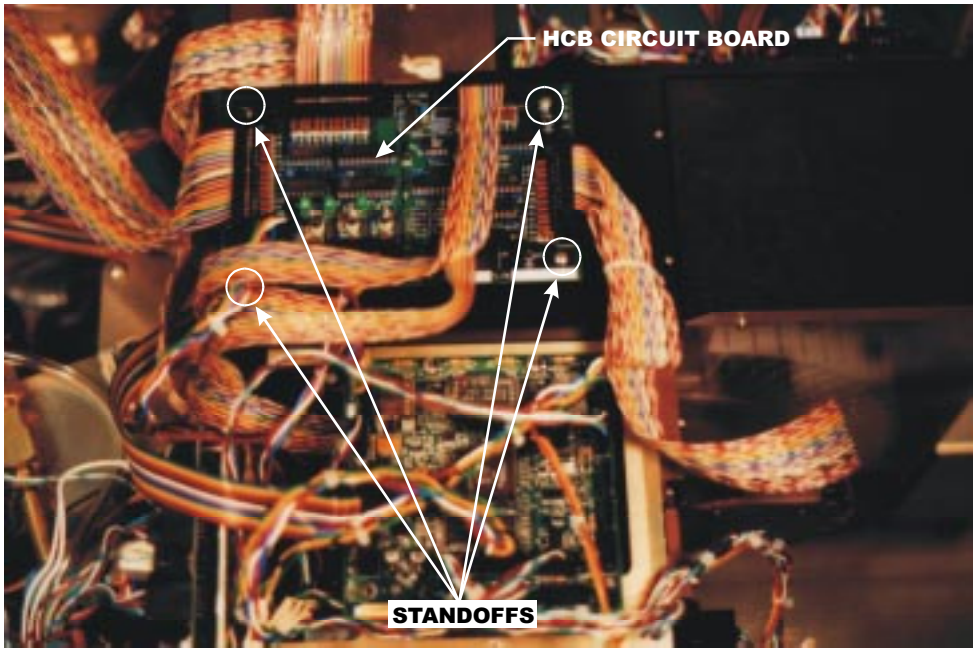


Figure 5-8 HCB Board Replacement

Installation

1. Place HCB board into the proper position noted from the removal of the old board and gently push the board on the standoffs.
2. Connect the cables to the HCB board as tagged from the removal of the old board.
3. Move the Diluter Cover (including the saline bag) back into place and secure. Reconnect the drain tube.
4. Close the access panels.
5. Ensure the instrument is ready to turn ON and verify proper operation. (Refer to Table 5-1 for any voltage readings and test point information.)

Sample Prep Node (SPN) Board Replacement

This procedure is common to all the SPN boards located inside the instrument. All SPN boards are interchangeable except the Vacuum / Sealer Board. Each SPN board will be mounted as close to the module as possible. The instrument is designed for easy access either by removing panels or access through hinged doors. This allows for easy serviceability and replacement of SPN boards.

SPN Board Jumper Configuration

Each SPN board is designed to perform the operational process of the system it is assigned. To accomplish the configuration of the particular system the SPN board is to control, the jumper configuration must be set to allow the SPN board to function to that system. Table 5-2 and Table 5-3 below lists the SPN board jumper location for the ***VITEK•2®-60*** and the ***VITEK•2®-120.*** The node number refers to the number that is used by the BCB to communicate with the SPN board and is provided for reference only.

Table 5-2 SPN Board Jumper Configuration for the ***VITEK•2®-60***

SPN BOARD P/N: 530704-1			
NODE	**INSTALLED JUMPERS**	**JP9 POSITION**	**DESCRIPTION**
1	---	---	<BCB>
2	JP2, JP9	1-2	Left Transport
3	JP3, JP9	1-2	Right Transport
4	JP4, JP9	1-2	Diluter
5	JP5, JP9	2-3	Pipettor
6	---	---	Vacuum / Sealer
7	JP7, JP9	1-2	Reader A
8	JP8, JP9	1-2	Carousel A

SPN BOARD P/N: 530704-2		
NODE	**INSTALLED JUMPERS**	**BOARD FUNCTION**
1	---	<BCB>
2	JP2	Left Transport
3	JP3	Right Transport
4	JP4	Diluter
5	JP5	Pipettor
6	---	Vacuum / Sealer
7	JP7	Reader A
8	JP8	Carousel A

Table 5-3 SPN Board Jumper Configuration for the ***VITEK•2®-120***

SPN BOARD P/N: 530704-2		
NODE	**INSTALLED JUMPERS**	**BOARD FUNCTION**
1	---	<BCB>
2	JP2	Left Transport
3	JP3	Right Transport
4	JP4	Diluter
5	JP5	Pipettor
6	---	Vacuum / Sealer
7	JP7	Reader A
8	JP8	Carousel A
9	JP1	Reader B
10	JP6	Carousel B

SPN Board Replacement

Refer to Tables 5-2 and 5-3 for the jumper configuration for the SPN board your are replacing. Figure 5-9 shows a typical SPN board.

Removal

1. Remove the instrument covers or access panels to expose the SPN board to be replaced.
2. Tag and disconnect the cables attached to the SPN board.
3. Note the mounting position of the board. With a flat tip screwdriver, gently pry the board from the standoffs holding the SPN board into place.
4. Note the jumper configuration and remove the SPN board.

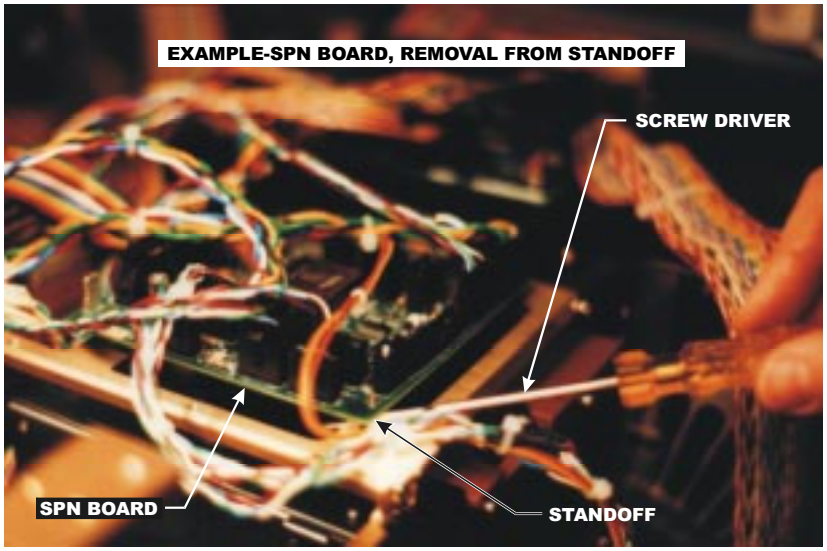


Figure 5-9 SPN Boards Replacement

Installation

1. Configure the jumper for the system the replacement SPN board is to control. Refer to the old board or Table 5-2 for the correct jumper configuration.
2. Place SPN board into the proper position noted from the removal of the old board and gently push board onto the standoffs.
3. Connect the cables to the SPN board as tagged from the removal of the old board.
4. Install the SPN chip from the old board, or replace with a current version SPN chip.
5. Install the access covers removed for replacement.
6. Ensure the instrument is ready to turn ON and verify proper operation. (Refer to Table 5-1 for any voltage readings and test point information.
7. From the diagnostic terminal confirm the following are displayed during the instrument initialization.

   (NOTE: If the instrument has completed initialization before the screen could be reviewed, use **FLASH_LOG_BOOT** command.)

   "BOOT Boat Management System is OK"
   "BOOT SEQ TASK 60 is OK"
   "BOOT FLASH Data File Verified"
   (If this is a 120, ensure "BOOT SEQ TASK 120 is OK".)

8. From the diagnostic prompt of the corresponding ***VITEK•2®***, type **restore_alignment** and press **ENTER**. (This command downloads the saved alignments from the BCB board to the SPN boards.)
9. From the diagnostic prompt type **fix_spn_params** and press **ENTER**. (This updates the SPN parameters as determined by the BCB firmware.)
10. Verify alignments. (See Appendix E - Alignment Procedure)

Display Assembly Replacement

Refer to Figure 5-10 for the location of the display assembly.

Removal

1. Open the top and front access covers on the instrument.
2. Disconnect the drain tube from the Diluter Cover and then unscrew and move the Diluter Cover (including the saline bag) to the side.
3. Remove the screws and lock washers attaching the Display Assembly to the instrument cabinet.
4. Remove the screw and lock washer to disconnect the ground wire from the frame.
5. Tag and disconnect the ribbon cable and backlight cable.
6. Remove the Display Assembly.

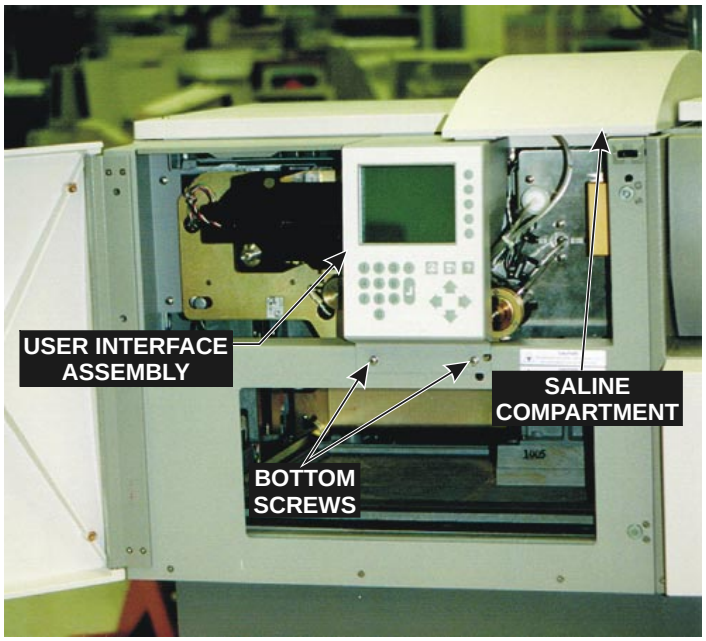


Figure 5-10 Display Assembly Replacement

Installation

1. Reconnect the display assembly cables.
2. Reattach the ground wire to the frame.
3. Place the Display Assembly into position on the instrument housing.
4. Install the mounting screws.
5. Move the Diluter Cover (including the saline bag) back into place and secure.
6. Reconnect the drain tube.
7. Close the access panels.
8. Ensure the instrument is ready to turn ON and verify proper operation. (Refer to Table 5-1 for any voltage readings and test point information.)

Card Handling System

The replacement card handling system component parts which we will cover in these procedures are very similar in physical steps for the specific area that they serve or control; however, they may be positioned or located throughout the instrument.

All the transporting motors are identical in manufacturer, but the biggest difference is what they are driving. Some motors are driving belts, the others are gear or directly coupled to a device or component they are driving.

These components will include the following:

- Timing Belts
- Pulley Motors
- Gear Motors
- Direct Drive Drum Motor
- Positioning Sensors
- Transports

Timing Belts

Refer to Figure 5-11 for an example of a timing belt.

Removal

1. Open or remove the access cover(s) from the area that exposes the timing belt you are replacing.
2. Press on the middle of the timing belt and make a mental note of the tension. Also turn the pulley and motor shaft and make a mental note of the force required to turn it by hand. (The replacement belt will need to be adjusted accordingly.)
3. Loosen the four mounting screws attaching the motor to the motor mount bracket. Slide the motor to loosen the timing.
4. Remove the belt from the motor pulley and discard belt.

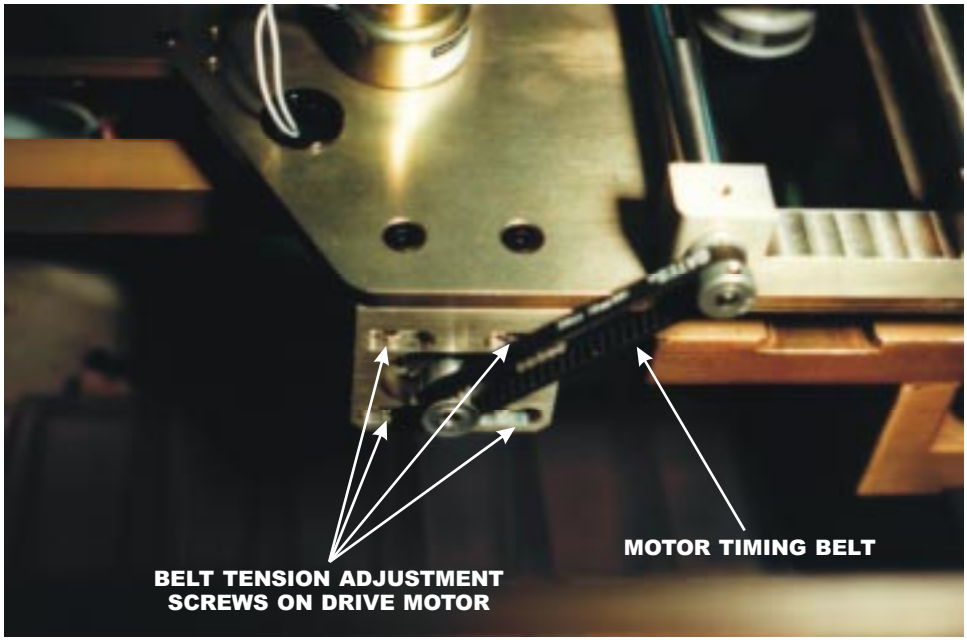


Figure 5-11 Example - Timing Belt

Installation

1. Install the new drive belt on the pulleys.
2. Position and tighten the motor so the belt tension is the same as previously noted. Rotate the motor shaft and pulley checking the force required to turn. Be sure not to over tighten belt.
3. Close the access doors or covers that were removed earlier.
4. Ensure the instrument is ready to be turned ON and verify the system operation.
5. Verify alignments. (See Appendix E - Alignment Procedure)

Pulley Motors

The ***VITEK•2®-60*** instrument has fourteen motors that use belts and pulleys and the ***VITEK•2®-120*** has sixteen. The motor assembly is identical for each of these different tasks.

- Paddle Motor (qty. 4)
- Transport Motor (qty. 4)
- Diluter Motor
- Pipettor Vertical Motor
- Pipettor Pivoting Motor
- Vacuum Motor
- Incubator Motor (qty. 2 for 120)
- Reader Head Motor (qty. 2 for 120)

The following is a list of the Stepper Motors pin and wiring connections.

Table 5-4 Stepper Motors Pin and Wiring Connections

STEPPER MOTORS	
PIN	**(PX244-03AA) WIRE COLOR**
1	White (Common)
2	Yellow (Common)
3	Blue
4	Red
5	Green
6	Black
Red, White, and Blue are connected. Black, Yellow, and Green are connected.	

Paddle Pulley Motor

Refer to Figure 5-12 for an example of the paddle pulley motor.

Removal

1. Open or remove the access cover(s) from the area that exposes the paddle pulley motor you are replacing.
2. Tag and disconnect the motor wires attached to the corresponding SPN board.
3. Press on the middle of the timing belt and make a mental note of the tension. Also turn the pulley and motor shaft and make a mental note of the force required to turn it by hand. (The belt will need to be adjusted accordingly after the replacement motor is installed.)
4. Loosen and remove the four mounting screws attaching the motor to the home bracket assembly. (Note the motor orientation to home bracket.)
5. Remove the timing belt and motor.
6. Measure and note the distance of the drive pulley mounted on the motor drive shaft.
7. Loosen the pulley set screws and remove from the motor shaft.
8. Discard the motor.

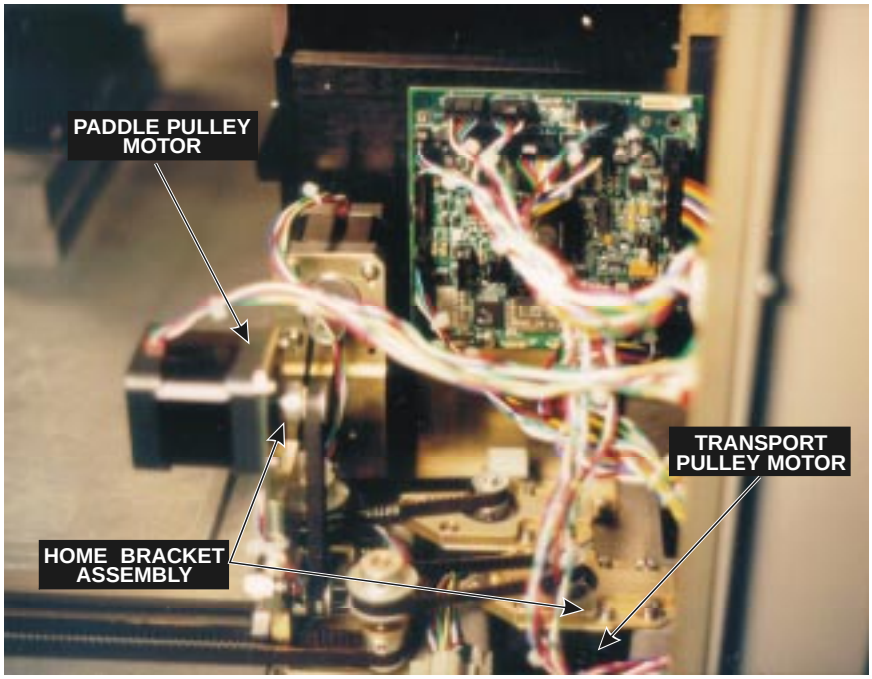


Figure 5-12 Paddle & Transport Pulley Motors

Installation

1. Install the motor pulley on the motor shaft to the distance measured during removal of motor. After applying threadlocking adhesive, place set screws of motor pulley over flat spots of shaft and tighten set screws securely.
2. Mount the motor to the home bracket assembly using the four mounting screws in the same orientation as removed.
3. Install the drive belt on the pulleys. Slide the motor to remove the slack in the drive belt. Position and tighten the motor so the belt tension is the same as noted earlier. (Rotate the motor shaft and pulley checking the force required.)
4. Reconnect the wires to the SPN board as tagged.
5. Install access doors or covers removed earlier.
6. Ensure the instrument is ready to be turned ON and verify the system operation.
7. After turning ON verify alignments. (See Appendix E - Alignment Procedure.)

Transport Pulley Motor

Refer to Figure 5-12 for an example of the transport pulley motor.

Removal

1. Open or remove the access cover(s) from the area that exposes the transport pulley motor you are replacing.
2. Tag and disconnect the motor wires attached to the corresponding SPN board.
3. Press on the middle of the timing belt and make a mental note of the tension. Also turn the pulley and motor shaft and make a mental note of the force required to turn it by hand. (The belt will need to be adjusted accordingly after the replacement motor is installed.)
4. Loosen and remove the three screws securing the transport motor assembly to the basepan.
5. Remove the timing belt and the transport motor assembly.
6. Loosen and remove the four mounting screws attaching the drive motor bracket to the motor. (Note the motor orientation to motor bracket.)
7. Measure and note the distance of the drive pulley mounted on the motor drive shaft.
8. Loosen the pulley set screws and remove from the motor shaft.
9. Discard the motor.

Installation

1. Install the motor pulley on the motor shaft to the distance measured during removal of motor. After applying Vibra-Tite threadlocking adhesive, place set screws of motor pulley over flat spot of shaft and tighten set screws securely.
2. Mount the motor to the drive motor bracket using the four mounting screws in the same orientation as removed.
3. Reinstall the transport motor assembly onto the basepan.
4. Install the drive belt on the pulleys. Slide the motor to remove the slack in the drive belt. Position and tighten the motor so the belt tension is the same as noted earlier. (Rotate the motor shaft and pulley checking the force required.)
5. Reconnect the wires to the SPN board as tagged.
6. Install access doors or covers removed earlier.
7. Ensure the instrument is ready to be turned ON and verify the system operation.
8. After turning ON, verify alignments. (See Appendix E - Alignment Procedure.)

Diluter Pulley Motor

Refer to Figure 5-13 for an example of the diluter pulley motor.

Removal

1. Open the “large” access door to expose the diluter assembly.
2. Tag and disconnect the motor wires attached to the diluter SPN board.

3. Press on the middle of the timing belt and make a mental note of the tension. Also turn the pulley and motor shaft and make a mental note of the force required to turn it by hand. (The belt will need to be adjusted accordingly after the replacement motor is installed.)
4. Loosen and remove the two screws securing the diluter pulley motor assembly to the diluter dispenser assembly.
5. Remove the timing belt and the diluter pulley motor assembly.
6. Loosen and remove the four mounting screws attaching the stepper motor mount to the motor. (Note the motor orientation to motor mount.)
7. Measure and note the distance of the drive pulley mounted on the motor drive shaft.
8. Loosen the pulley set screws and remove from the motor shaft.
9. Discard the motor.

Figure 5-13 Diluter Pulley Motor

Installation

1. Install the motor pulley on the motor shaft to the distance measured during removal of motor. After applying threadlocking adhesive, place set screws of motor pulley over flat spot of shaft and tighten set screws securely.
2. Mount the motor to the stepper motor mount using the four mounting screws in the same orientation as removed.
3. Reinstall the diluter motor assembly onto the diluter dispenser assembly.
4. Install the drive belt on the pulleys. Slide the motor to remove the slack in the drive belt. Position and tighten the motor so the belt tension is the same as noted earlier. Rotate the motor shaft and pulley checking the force required. (If the belt tension is too tight, it will loose motor steps while performing a diluter cycle.)
5. Reconnect the wires to the diluter SPN board as tagged.
6. Close “large” access door.
7. Ensure the instrument is ready to be turned ON and verify the system operation.
8. After turning ON, verify alignments. (See Appendix E - Alignment Procedure.)

Pipettor Vertical Pulley Motor

Refer to Figure 5-14 for an example of the pipettor vertical pulley motor.

Removal

1. Open the “large” access door to expose the pipettor system assembly.
2. Tag and disconnect the motor wires attached to the pipettor SPN board.
3. Press on the middle of the timing belt and make a mental note of the tension. Also turn the pulley and motor shaft and make a mental note of the force required to turn it by hand. (The belt will need to be adjusted accordingly after the replacement motor is installed.)
4. Loosen and remove the four mounting screws attaching the motor to the vertical motor mount. (Note the motor orientation to motor mount.)
5. Remove the timing belt and the pipettor pulley motor.
6. Measure and note the distance of the drive pulley mounted on the motor drive shaft.
7. Loosen the pulley set screws and remove from the motor shaft.
8. Discard the motor.

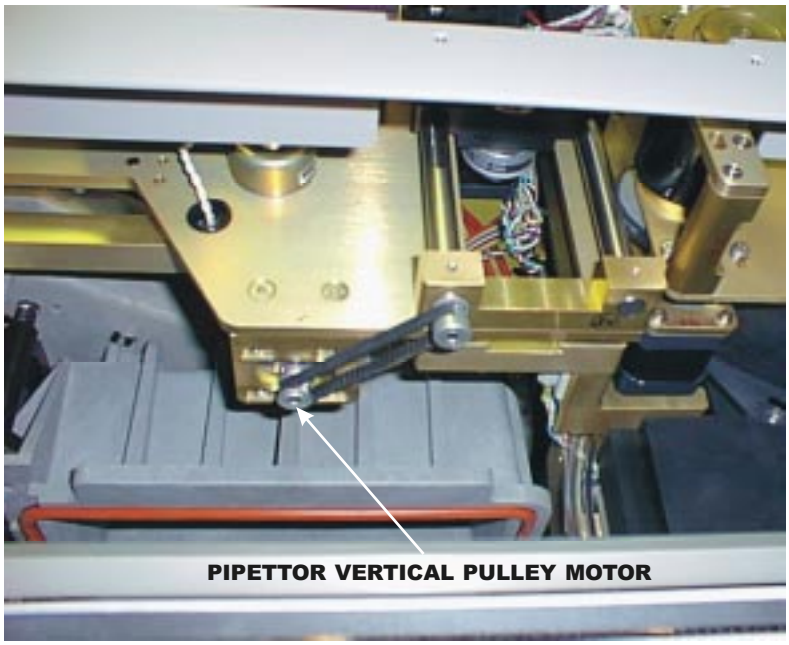


Figure 5-14 Pipettor Vertical Pulley Motor

Installation

1. Install the motor pulley on the motor shaft to the distance measured during removal of motor. After applying threadlocking adhesive, place set screws of motor pulley over flat spot of shaft and tighten set screws securely.
2. Install the four mounting screws attaching the motor to the vertical motor mount in the same orientation as removed.

3. Install the drive belt on the pulleys. Slide the motor to remove the slack in the drive belt. Position and tighten the motor so the belt tension is the same as noted earlier. (Rotate the motor shaft and pulley checking the force required.)
4. Reconnect the wires to the pipettor SPN board as tagged.
5. Close "large" access door.
6. Ensure the instrument is ready to be turned ON and verify the system operation.
7. After turning ON, verify alignments. (See Appendix E - Alignment Procedure.)

Pipettor Pivoting Pulley Motor

Refer to Figure 5-15 for an example of the pipettor pivoting pulley motor.

Removal

1. Open the "large" access door to expose the pipettor system assembly.
2. Remove the display assembly and set it aside.
3. Tag and disconnect the motor wires attached to the pipettor SPN board.
4. Press on the middle of the timing belt and make a mental note of the tension. Also turn the pulley and motor shaft and make a mental note of the force required to turn it by hand. (The belt will need to be adjusted accordingly after the replacement motor is installed.)
5. Loosen and remove the two mounting screws attaching the motor assembly to the pipettor vertical slide.
6. Remove the timing belt and the pipettor pulley assembly.
7. Loosen and remove the four mounting screws attaching the motor and the stepper motor mount. (Note the motor orientation to motor mount.)
8. Measure and note the distance of the drive pulley mounted on the motor drive shaft.
9. Loosen the pulley set screws and remove from the motor shaft.
10. Discard the motor.

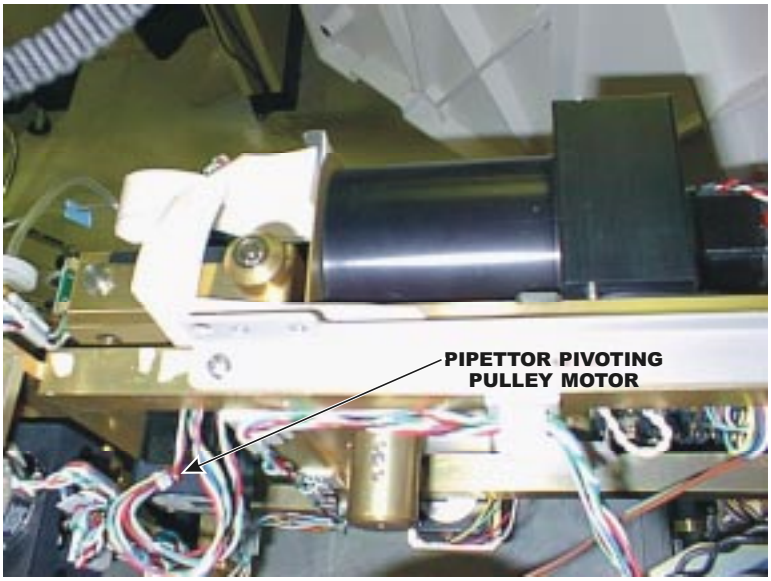


Figure 5-15 Pipettor Pivoting Pulley Motor (Top View)

Installation

1. Install the motor pulley on the motor shaft to the distance measured during removal of motor. After applying threadlocking adhesive, place set screws of motor pulley over flat spots of shaft and tighten set screws securely.
2. Install the four mounting screws attaching the motor to the stepper motor mount in the same orientation as removed.
3. Reinstall the motor assembly to the pipettor vertical slide.
4. Install the drive belt on the pulleys. Slide the motor to remove the slack in the drive belt. Position and tighten the motor so the belt tension is the same as noted earlier. (Rotate the motor shaft and pulley checking the force required.)
5. Reconnect the wires to the pipettor SPN board as tagged.
6. Reinstall the display assembly.
7. Close "large" access door.
8. Ensure the instrument is ready to be turned ON and verify the system operation.
9. After turning ON, verify alignments. (See Appendix E - Alignment Procedure.)

Vacuum Assembly Vertical Motor

Refer to Figure 5-16 for an example of the vacuum assembly vertical motor.

Removal

1. Open the top panel door and the "large" access door to expose the vacuum assembly.
2. Loosen and remove the 4 screws securing the vacuum belt drive plate to the upper bearing mount.
3. Tag and disconnect the necessary wires and connectors and then slide the plate assembly behind the vacuum chamber.
4. Tag and disconnect the motor wires attached to the vacuum sealer board.
5. Place a boat against the left and back side rails of the base pan.
6. Press on the middle of the timing belt and make a mental note of the tension. Also turn the pulley and motor shaft and make a mental note of the force required to turn it by hand. (The belt will need to be adjusted accordingly after the replacement motor is installed.)
7. Manually turn the belt until the vacuum chamber barely touches the boat's sealing surface.
8. Loosen the idler pulley bracket to add slack to the belt. (NOTE: Before loosening anything, secure belt to the lead (drive) screw pulleys so phasing is not lost during motor replacement. This will save time and effort trying to re-phase belt to lead screws.)
9. While supporting the stepper motor located beneath the upper bearing mount, loosen and remove the four mounting screws securing the motor.
10. Remove the motor. (Note the motor orientation to bearing mount.)
11. Measure and note the distance of the drive pulley mounted on the motor drive shaft.
12. Loosen the pulley set screws and remove from the motor shaft.
13. Discard the motor.

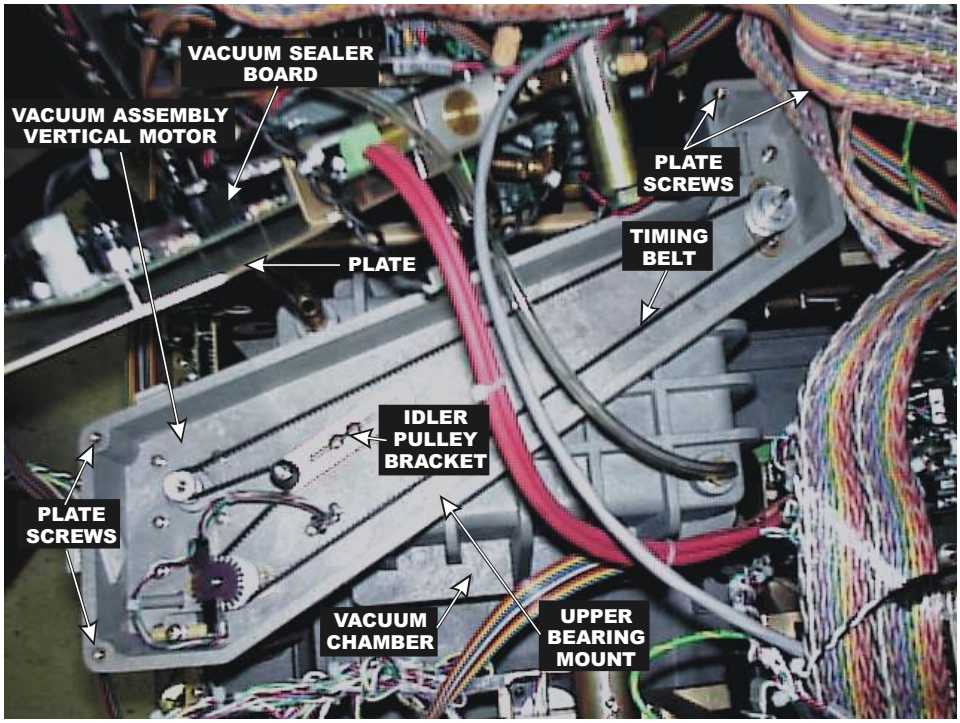


Figure 5-16 Vacuum Assembly Vertical Motor (plate removed)

Installation

1. Install the motor pulley on the motor shaft to the distance measured during removal of motor. After applying threadlocking adhesive, place set screws of motor pulley over flat spots of shaft and tighten set screws securely.
2. Mount the stepper motor to the upper bearing mount in the same orientation as removed.
3. Place the timing belt around the motor pulley and pull belt taught using the idler pulley bracket.
4. If the belt was previously secured to the lead screw pulleys during the *Removal* process, then release the hold from the belt (keeping belt taught so phasing is not lost). Tighten and secure the belt so it's tension is the same as noted earlier. (Rotate the motor shaft and pulley checking the force required.) Verify phasing.
5. If phasing has been lost, position the belt so the vacuum chamber gasket just barely touches the boat's sealing surface equally around the periphery and tighten.
6. To verify phasing, slowly turn the belt by hand right and then left. Make sure when the vacuum chamber is lowered, its gasket touches the boat at the same time. If it does not, loosen belt slightly and adjust by repositioning the notches of the belt respectively with the pulleys.
7. Once phasing has been verified and the belt tension is correct, position and secure the vacuum belt drive plate to the upper bearing mount.
8. Reconnect all wires previously disconnected.
9. Close the doors.
10. Ensure the instrument is ready to be turned ON and verify the system operation.
11. After turning ON, verify alignments. (See Appendix E - Alignment Procedure.)

Incubator Motor

Refer to Figure 5-17a for an example of the incubator motor.

Removal

1. Open the top panel door and remove left rear panel to expose the incubator assembly.
2. Remove and set aside the incubator access cover.
3. Remove two of the carousel quadrants to expose the right side of the right hockey table plate. (With the instrument turned off it is easy to turn the belt drive assembly by hand, positioning the quadrants for removal.)
4. Loosen and remove the 5 screws securing the right hockey table plate. Remove the plate.
5. Tag and disconnect the motor wires attached to the carousel SPN board.
6. Loosen and remove the two mounting screws securing the heat sink motor bracket to the incubator assembly. Remove the bracket and motor.
7. Loosen and remove the four screws mounting the stepper motor to the heat sink motor bracket. (Note the motor orientation to bracket.)
8. Measure and note the distance of the drive pulley mounted on the motor drive shaft.
9. Loosen the pulley set screws and remove from the motor shaft.
10. Discard the motor.

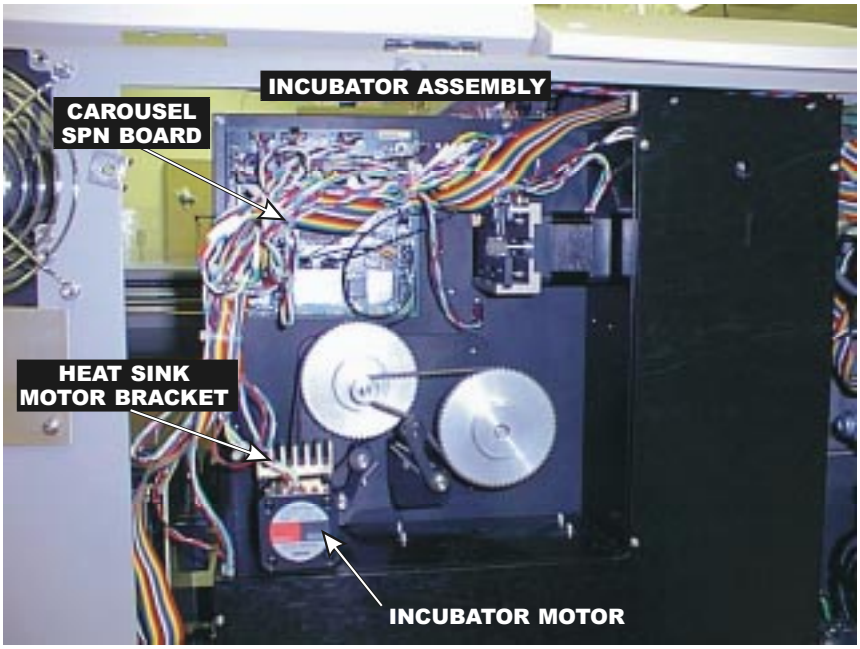


Figure 5-17a Incubator Motor

Installation

1. Install the motor pulley on the motor shaft to the distance measured during removal of motor. After applying threadlocking adhesive, place set screws of motor pulley over flat spots of shaft and tighten set screws securely.
2. Mount the replacement stepper motor to the heat sink motor bracket in the same orientation as removed.
3. Place the motor and bracket in its mounting position on the incubator. Install the belt and then secure the bracket.
4. Reconnect the wires to the carousel SPN board as tagged.
5. Reinstall the right hockey table plate.
6. Reinstall the two carousel quadrants.
7. Reinstall left rear panel and close the top panel door.
8. Ensure the instrument is ready to be turned ON and verify the system operation.
9. After turning ON, verify alignments. (See Appendix E - Alignment Procedure.)

Forthcoming Design Change

Figure 5-17b shows an example of the upcoming molded incubator assembly. The incubator motor replacement will be easily achieved through back access.

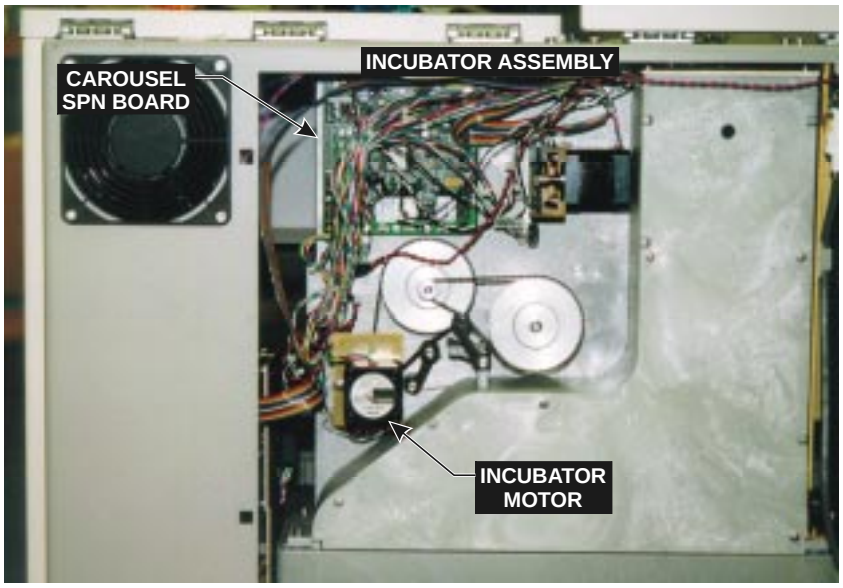


Figure 5-17b Molded Incubator Assembly

Reader Head Motor

Refer to Figure 5-18 for an example of the reader head motor.

Removal

1. Open the top panel door and remove the side cover to expose the reader head assembly.
2. Tag and disconnect the motor wires attached to the reader SPN board.
3. Open the optics and press on the belt where the optics sit. Make a mental note of the belt tension. Also turn the motor shaft and pulley of the reader head motor and make a mental note of the force required to turn it by hand. (When re-assembling, the belt will need to be adjusted accordingly.)
4. Loosen the timing belt motor and push it upward, adding slack to the belt.
5. Loosen and remove the four mounting screws securing the stepper motor to the reader motor bracket. Remove the motor. (Note the motor orientation of motor bracket.)
6. Measure and note the distance of the drive pulley mounted on the motor drive shaft.
7. Loosen the pulley set screws and remove from the motor shaft.
8. Discard the motor.

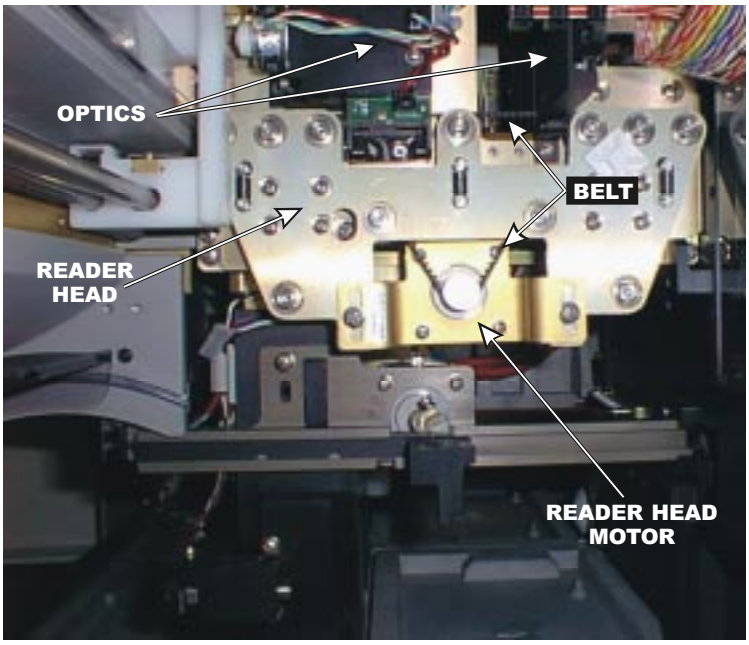


Figure 5-18 Reader Head Motor

Installation

1. Install the motor pulley on the motor shaft to the distance measured during removal of motor. After applying threadlocking adhesive, place set screws of motor pulley over flat spots of shaft and tighten set screws securely.
2. Install the stepper motor in the same orientation to bracket as removed. Place belt around the motor pulley.
3. Position and tighten the motor so the belt tension is the same as noted earlier. (Open the optics to check the belt tension and rotate the motor shaft and pulley checking the force required.)
4. Reconnect the wires to the reader SPN board as tagged.
5. Reinstall side cover and close the top panel door.
6. Ensure the instrument is ready to be turned ON and verify the system operation.
7. After turning ON, verify alignments. (See Appendix E - ***VITEK•2®*** Alignment Procedure.)

Gear Motor Replacement

The ***VITEK•2®*** instrument has four motors installed which use gears. The motor assembly is identical for each of these different tasks.

- Auto Loader Motor
- Card Ejector Motor
- Cam Motor
- Stacker Motor (qty. 2 for 120)

Auto Loader Motor Replacement

Refer to Figure 5-19 for the location of the auto loader motor.

Removal

1. Open the top panel door and remove the side cover to expose the motor you are replacing.
2. Tag and disconnect the motor wires attached to the Reader SPN Board.
3. Move the auto loader rack by hand to expose the bottom two pan head screws securing the motor. (Note the motor orientation to the auto loader guide.)
4. Loosen and remove the four mounting screws attaching the motor to the back of the auto loader guide.
5. Measure and note the distance of the tray drive gear mounted on the motor drive shaft.
6. Loosen the hex screw and remove the gear from the motor shaft.
7. Discard the motor.

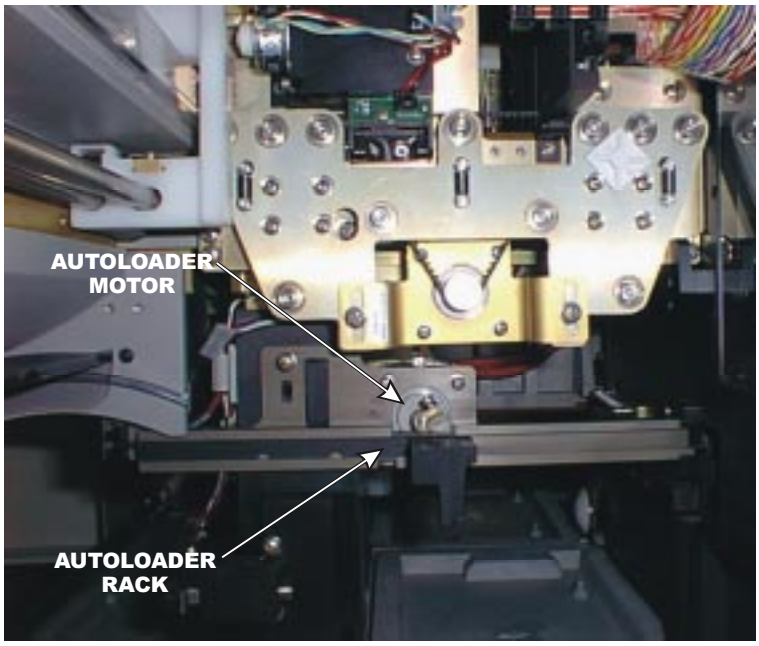


Figure 5-19 Auto Loader Motor

Installation

1. Position the tray drive gear on the motor shaft to the distance measured during removal and tighten screw securely.
2. Mount the replacement motor onto the auto loader guide in the same orientation as removed.
3. When tightening the motor mounting screws make sure the drive gear engages the rack enough to remove backlash, but not tight enough to produce binding.
4. Connect the motor wires to the Reader SPN board as previously noted.
5. Install or close any access doors or covers previously removed.
6. Ensure the instrument is ready to turn ON.
7. Verify the motor is operating properly and verify alignment. (See Appendix E - Alignment Procedure.)
8. (See Table 5-4 for wiring information.)

Card Ejector Motor Replacement

Refer to Figure 5-20 for the location of the card ejector motor.

Removal

1. Remove the right rear panel to expose the motor you are replacing.
2. Tag and disconnect the motor wires attached to the Incubator SPN Board.
3. Move the ejector blade by hand to expose the four pan head screws securing the motor.
4. Loosen and remove the four mounting screws attaching the motor to the back of the ejector rack. (Note the motor orientation to the ejector rack.)
5. Measure and note the distance of the tray drive gear mounted on the motor drive shaft.
6. Loosen the hex screw and remove the gear from the motor shaft.
7. Discard the motor.

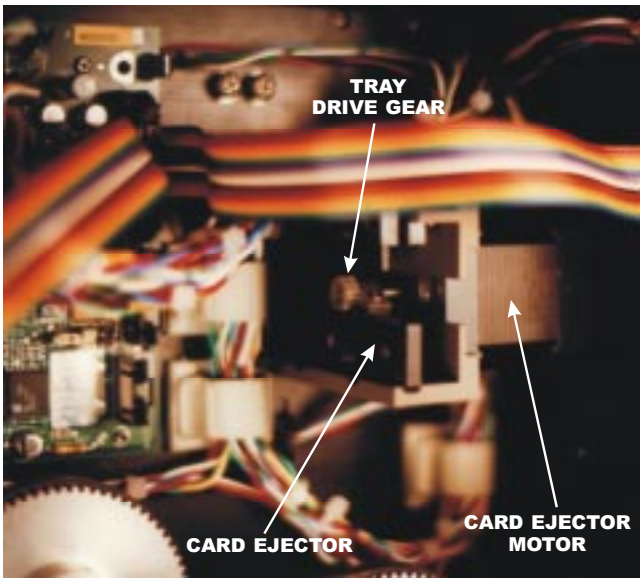


Figure 5-20 Card Ejector Motor (Back View)

Installation

1. Position the tray drive gear on the motor shaft to the distance measured during removal and tighten hex screw securely
2. Mount the replacement motor onto the ejector rack in the same orientation as removed.
3. When tightening the motor mounting screws make sure the drive gear engages the rack enough to remove backlash, but not tight enough to produce binding.
4. Connect the motor wires to the Incubator SPN board as previously noted.
5. Install or close any access doors or covers previously removed.
6. Ensure the instrument is ready to turn ON.
7. Verify the motor is operating properly and verify alignment. (See corresponding section.) (See Table 5-4 for wiring information.)

Cam Motor Replacement

Refer to Figure 5-21 for the location of the cam motor.

Removal

1. Open the top panel doors of the instrument. Disconnect the drain tube from the Diluter Cover and then unscrew and move the Diluter Cover (including the saline bag) to the side.
2. Carefully pry the Reader SPN board from the standoffs and push the board aside, allowing access to the cam motor.
3. While supporting the cam motor on the inside of the reader head, loosen and remove the cam motor assembly's two mounting screws.
4. Carefully lift the cam motor assembly from reader head.
5. Loosen and remove the four mounting screws attaching the motor to the motor mount bracket. (Note the motor orientation to the bracket.)
6. Measure and note the distance of the tray drive gear mounted on the motor drive shaft.
7. Loosen the set screws and remove the gear from the motor shaft.
8. Discard the motor.

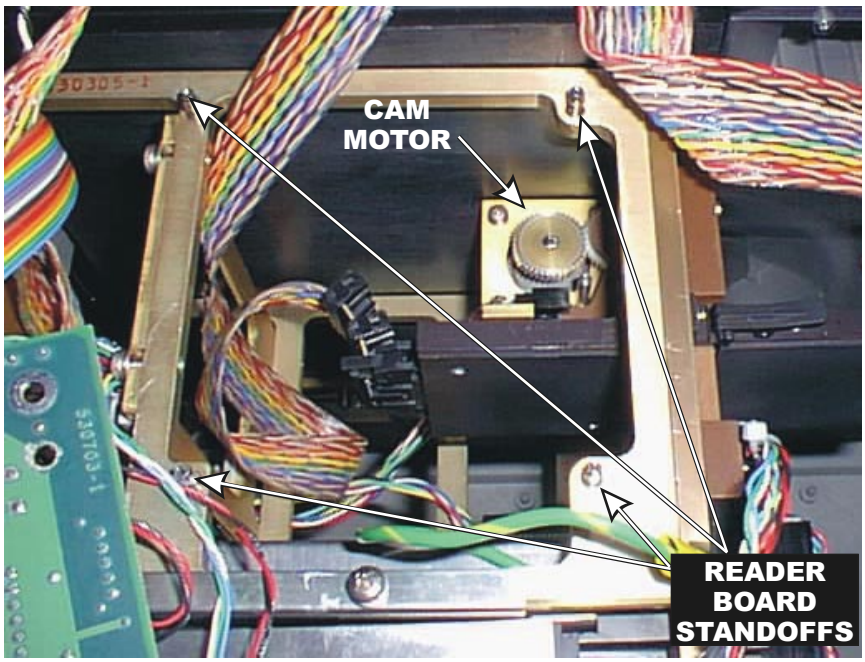


Figure 5-21 Cam Motor (Top View)

Installation

1. Position the tray drive gear on the motor shaft to the distance measured during removal of the motor. After appying thread locking adhesive, place the set screws of the motor pulley over flat spots of the shaft and tighten set screws securely.
2. Mount the replacement motor onto the motor mount bracket in the same orientation as when removed.
3. When tightening the motor mounting screws make sure the drive gear engages the rack enough to remove backlash, but not tight enough to produce binding.
4. Carefully place the cam motor assembly inside the reader head and while supporting the cam motor reinstall the assembly using two mounting screws.
5. Connect the motor wires to the Reader SPN board as previously noted.
6. Carefully snap the Reader SPN board back onto the standoff posts.
7. Re-install the Diluter Cover (including the saline bag) and then re-connect the drain tube.
8. Close the top access doors.
9. Ensure the instrument is ready to turn ON.
10. Verify the motor is operating properly and verify alignment. (See Appendix E - Alignment Procedure.)
11. (See Table 5-4 for wiring information.)

Stacker Motor Replacement

Refer to Figure 5-22 for the location of the auto loader motor.

Removal

1. Open the top panel door and remove the side cover to expose the stacker assembly.
2. Remove the magazine assembly and the waste door and set them both aside.
3. Remove the magnet bracket and set it aside.
4. Tag and disconnect the motor wires attached to the Reader SPN Board.
5. Loosen and remove the three pan head screws securing the stacker card assembly.
6. Carefully remove the stacker card assembly by lifting it up and out to the right. (Warning: The wide optical switch assembly in the stacker card assembly may be damaged during removal. If there is resistance when removing the stacker card assembly, loosen the pipettor/diluter cover to allow clearance for the optical switch.)
7. Remove the push rack from the push slide bracket.
8. Loosen and remove the four mounting screws attaching the motor to the push slide bracket. (Note the orientation of the motor to the push slide bracket.)
9. Measure and note the distance of the tray drive gear mounted on the motor drive shaft.
10. Loosen the set screws and remove the gear from the motor shaft.
11. Discard the motor.

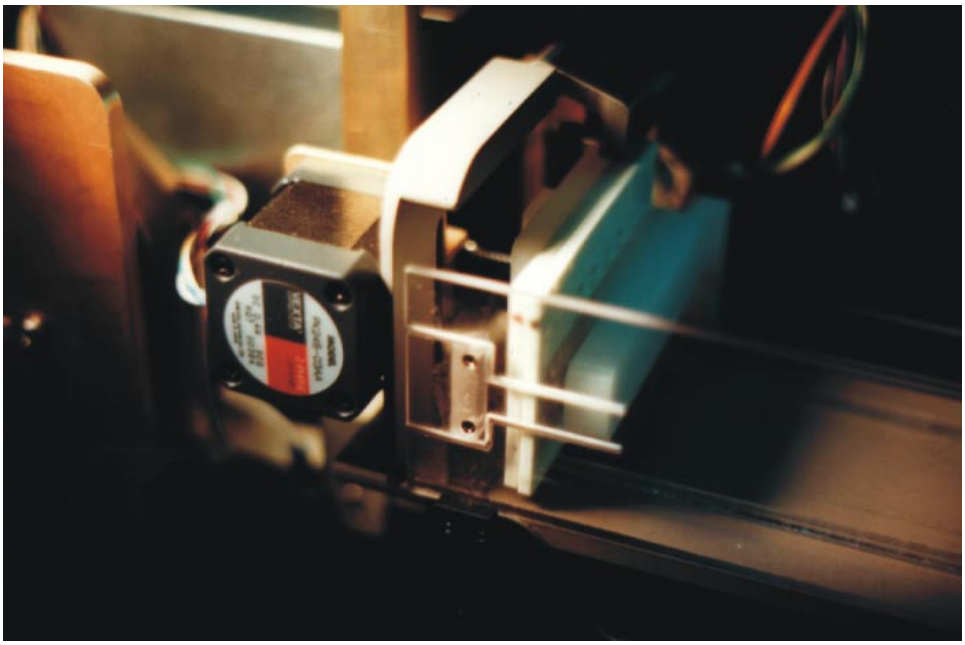


Figure 5-22 Stacker Motor

Installation

1. Position the tray drive gear on the motor shaft to the distance measured during removal and tighten set screws securely.
2. Mount the replacement motor onto the push slide bracket in the same orientation as when removed. Reinstall the push rack.
3. When tightening the motor mounting screws make sure the drive gear engages the rack enough to remove backlash, but not tight enough to produce binding.
4. Carefully reinstall the stacker card assembly and secure the three pan head screws.
5. Connect the motor wires to the Reader SPN board as previously noted.
6. Reinstall the magnet bracket, waste door and magazine assembly.
7. Install or close any access doors or covers previously removed.

Direct Drive Drum Motor

Refer to Figure 5-23 for an example of the direct drive drum motor.

Removal

1. Open the "large" front door and the pipettor drum lid to expose the direct drive drum motor.
2. Tag and disconnect the motor wires attached to the pipettor SPN board.
3. Open the pipettor drum lid and remove the pipettor drum assembly. (NOTE: Take caution not to contaminate the pipette tips inside the drum.)
4. Loosen and remove the four screws mounting the drum motor assembly to the pipettor drum cam plate.
5. Remove the drum motor assembly.
6. Measure and note the distance of the drive lug mounted on the motor drive shaft.
7. Loosen the drive lug set screws and remove from the motor shaft.
8. Discard the motor.

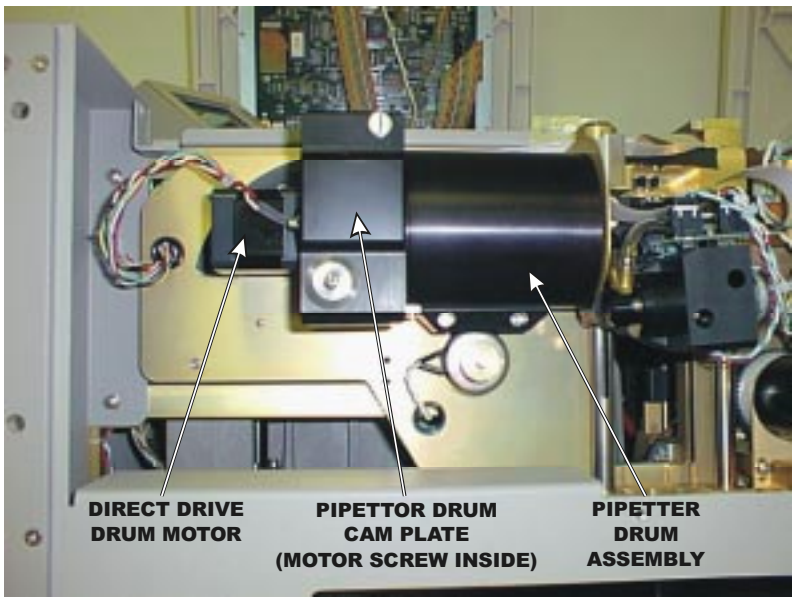


Figure 5-23 Direct Drive Drum Motor

Installation

1. Install the drive lug on the motor shaft to the distance measured during removal of motor. After applying threadlocking adhesive, place set screws of motor pulley over flat spots of shaft and tighten set screws securely.
2. Mount the drum motor assembly to the pipettor drum cam plate.
3. Connect the motor wires to the pipettor SPN board.
4. Reinstall the drum assembly.
5. Close the pipettor drum lid and the front door.
6. Ensure the instrument is ready to be turned ON and verify the system operation.
7. After turning ON, verify alignments. (See Appendix E - Alignment Procedure.)

Instrument Positioning Sensors / Switches

The positioning sensor / switch replacement and installation procedures are grouped together due to the consistency of their use in the instrument. The specific location of the sensors / switches will require the user to open or remove panels to access the area they serve. Most sensors / switches will be positioned in the closest proximity to the system they are to monitor.

The ***VITEK•2®*** instrument has the following types of sensors / switches:

- Optical Switch Assembly sensors
- Hall Effect (proximity) sensor
- Reflective sensors
- Snap Acting switch

Optical Switch Assembly Sensors

All photoelectric optical sensors, for the most part, operate identical. The only change would be in the physical construction of the specific sensing arrangement. All have mounting screws and bases along with wiring for board connection (see Figure 5-24 for an example.) Table 5-5 lists the optical switch assembly sensor wiring configuration.

Table 5-5 Optical Sensor Pin and Wiring

OPTICAL SWITCH ASSEMBLY SENSOR WIRING		
PIN	**SIGNAL**	**WIRE COLOR**
1	+5VDC - Detector	White
2	Negative - Emitter	Black
3	Positive - Emitter	Red
4	Ground - detector	Green
5	Sense Out - Detector	Blue

Removal

1. Open the door or remove the access cover of the instrument to access the optical sensor.
2. Disconnect and tag all cables from the SPN board to where to optical sensor attaches. Note the mounting position.
3. Remove the screw and lock washers holding the sensor and remove the sensor from the instrument.

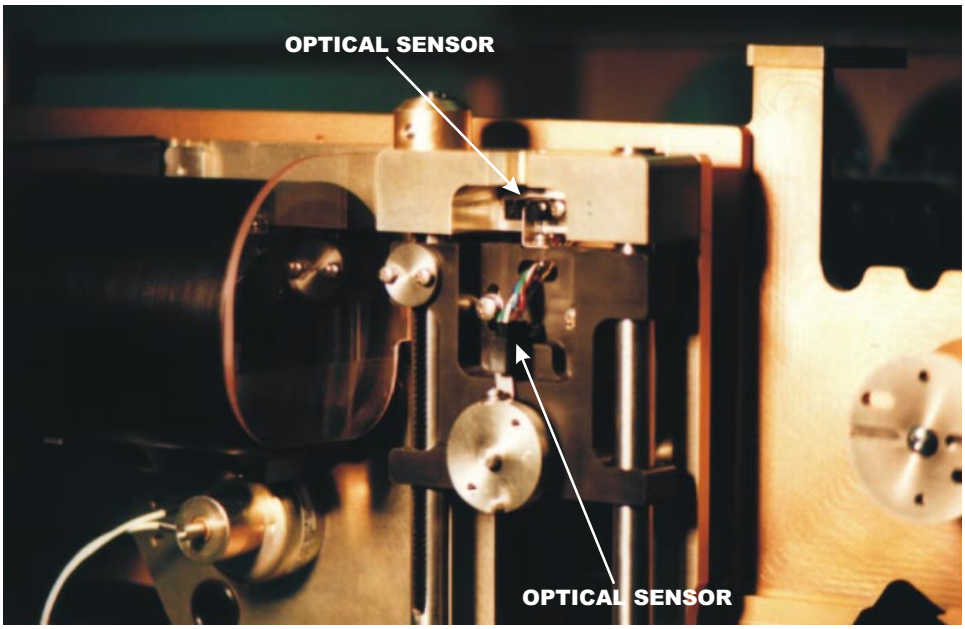


Figure 5-24 Example - Optical Switch Assembly Sensor

Installation

1. Place the new optical switch assembly sensor into position and install the mounting screws.
2. Reconnect the cables to the SPN board connectors that were previously removed.
3. Install or close any access doors or covers previously removed.
4. Ensure the instrument is ready to turn ON and verify sensor operates properly. (See Table 5-5 for wiring information.)
5. Verify alignments. (See Appendix E - Alignment Procedure.)

Optical Switch Assembly Sensors (part number 530119-1)
Transport Paddle Switch Assy. (Qty 4)
Transport Home Switch Assy. (Qty 4)
Transport Encoder Switch Assy (Qty 2) (Front & Back for counting steps)
Pipettor Vertical Home Switch Assembly
Pipettor Rotor Home Switch Assembly
Diluter Tilt Home Switch Assembly
Diluter Pump Home Switch Assembly
Vacuum Home Switch Assembly
Vacuum Encoder Switch Assembly
Sealer Home Switch Assembly
Carousel Home Switch (A & B)
Auto Loader Home Switch (A & B)
Ejector Home Switch (A & B)
Stacker Push Plate Home Switch (A & B)
Auto-Cal Home Switch (Fluorescence)
Cam Home Switch

Wide Optical Switch Assembly Sensors
Carousel Index Top Sensor (p/n 530154-1)
Carousel Index Bottom Sensor(p/n 530154-1)
Incubator Cover Switch. (p/n 530154-1)
Stacker Empty Switch Sensors (p/n 530154-2)
Left & Right Lid Sensors (Qty 2) (p/n 530157-1)
Front Slide Sensor (Qty 1 – 120 only) (p/n 530157-1)

Other Optical Switch Assembly Sensors
Diluter Sensor Assy. (Wide sensor on PCB) (p/n 530738)
Pipettor Pump Home Switch Assembly (p/n 530160-1)
Pipettor Tip Pine Home Switch Assembly (p/n 530159-1)
Card Separator Switch Assembly (p/n 531114-1)
Pipettor/Diluter Cover Sensor Assembly (Front Door) (p/n 531110-1)

Pipettor Hall Effect (proximity) Sensor

The ***VITEK•2®*** has only one Hall Effect sensor. The sensor is located on the base that holds the drum. Refer to Figure 5-25 for location of the proximity sensor. Table 5-6 lists the proximity sensor wiring configuration.

Table 5-6 Proximity Sensor Pin and Wiring

PROXIMITY SENSOR WIRING (p/n 530156-1)		
PIN	**SIGNAL**	**WIRE COLOR**
1	+5VDC - Detector	Red
2	Negative - Emitter	N/C
3	Positive - Emitter	N/C
4	Ground - detector	Black
5	Sense Out - Detector	White

Removal

1. Open the front left access door to access the pipettor drum. Lift the top cover over the pipettor drum.
2. Tag and disconnect the sensor cable from the SPN circuit board.
3. Remove the screw and lock washers holding the sensor and remove the sensor from the drum.

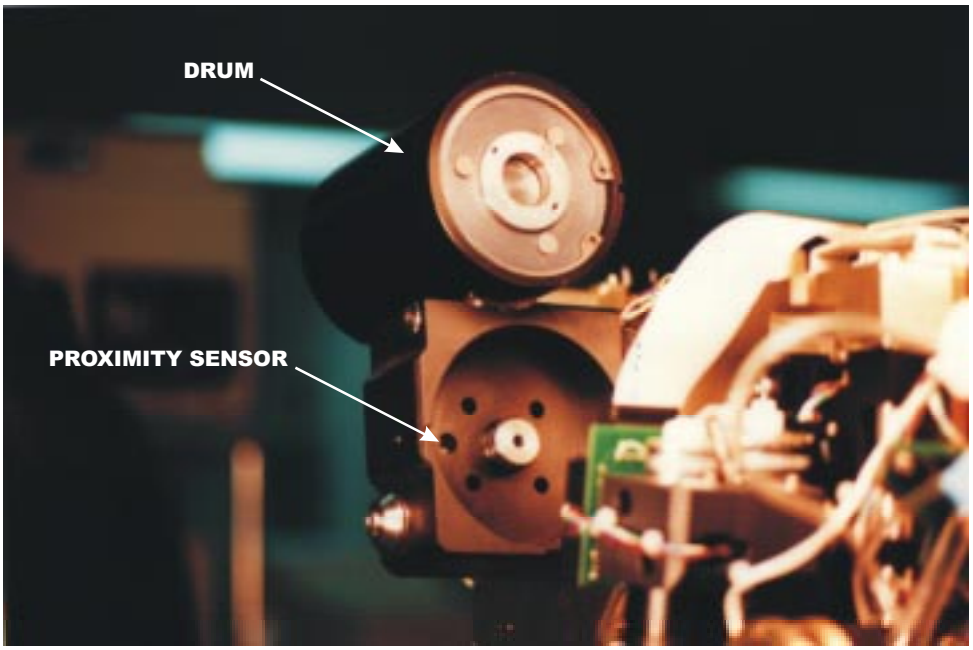


Figure 5-25 Pipettor Hall Effect Sensor

Installation

1. Place the new hall effect sensor into position and install the mounting screws.
2. Reconnect the cable to the SPN circuit board connector as noted from removal.
3. Install or close any access doors or covers previously removed.
4. Ensure the instrument is ready to turn ON and verify the sensor operates properly. (See Table 5-6 for wiring information.) (See Appendix E - Alignment Procedure.)

Reflective Sensor Replacement

The ***VITEK•2®-60*** has two reflective sensors and the ***VITEK•2®-120*** has three. All three reflective sensors operate identical. The only change would be in the physical positioning or mounting. See Figure 5-26 for an example of the Reflective Sensor. Table 5-7 lists the reflective sensor wiring configuration.

Reflective Sensors
Loading Station Cassette Detector (p/n 530161-1)
Left Front Boat Sensor Assy (p/n 530181-1)
Stacker Cover Sensor [Vitek 120] (p/n 530181-1)

Table 5-7 Reflective Sensor Pin and Wiring

REFLECTIVE SENSOR WIRING		
PIN	**SIGNAL**	**WIRE COLOR**
1	+5VDC - Detector	N/C
2	Negative - Emitter	Black
3	Positive - Emitter	Red
4	Ground - detector	Green
5	Sense Out - Detector	White

Removal

1. Open the front door(s) or remove any access cover(s) of the instrument to access the reflective sensor.
2. Tag and disconnect the sensor cable attached to the respective SPN board. Note the mounting position.
3. Remove the screw and lock washers holding the sensor and remove the sensor from the mounting bracket.

Figure 5-26 Example - Reflective Sensor

Installation

1. Place the new reflective sensor onto the mounting bracket in the position as noted from the removal. Install the mounting screws. (The loading station cassette detector should be located 2-2.5 mm from edge of Daily Panel. If the left front boat sensor assembly is mounted to the boat sensor bracket, it should mount flush with the edge. Otherwise mount directly to the base pan. Positioning of the green and white wires for both reflective sensors should be closest to the front of the instrument.)
2. Reconnect the cables to the SPN circuit board connector that were previously removed.
3. Install or close any access doors or covers previously removed.
4. Ensure the instrument is ready to turn ON and verify the sensor is operating properly. (See Table 5-7 for wiring information.)

Snap Action Switch

The snap action switch, is located at the waste collection station and signals when the waste collection tray is in place. The switch is a “make-break” switch and located under the front lip. Figure 5-27 shows the location of the snap acting switch.

Removal

1. Open the waste collection station access door. Remove the collection tray and set aside.
2. Remove the screws and lock washers holding the switch.
3. Tag and remove the wires from the switch. Note the switch position and remove the switch from the instrument.

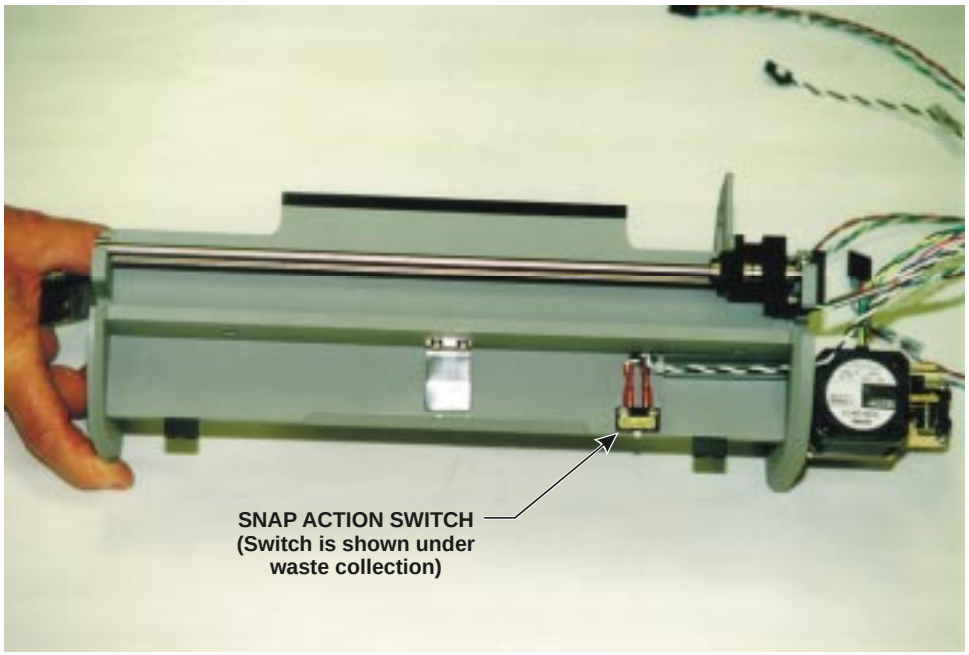


Figure 5-27 Example - Snap Action Switch

Installation

1. Reconnect the wiring to the switch terminal spade connections.
2. Place the new switch in the instrument to the position as noted from the removal. Install the mounting screws.
3. Install the waste collection tray and close any access covers or doors previously removed.
4. Ensure the instrument is ready to turn on and verify the sensor is operating properly.

Transport Assembly Component Replacement

The transport replacement and installation procedures are grouped together due to the consistency of their use in the instrument. The specific location of each of the transports will require the user to open or remove panels to access the area they serve.

All transports for the most part operate identical. The only change would be in the physical length or bracket construction of the specific transport. All of the transport assemblies have mounting screws and bases along with a drive motor, motor drive belt, transport paddle drive belts, positioning sensor, and associated wiring from the motors for connection to the SPN board. Refer to Figure 5-28a and Figure 5-28b for location of the transports.

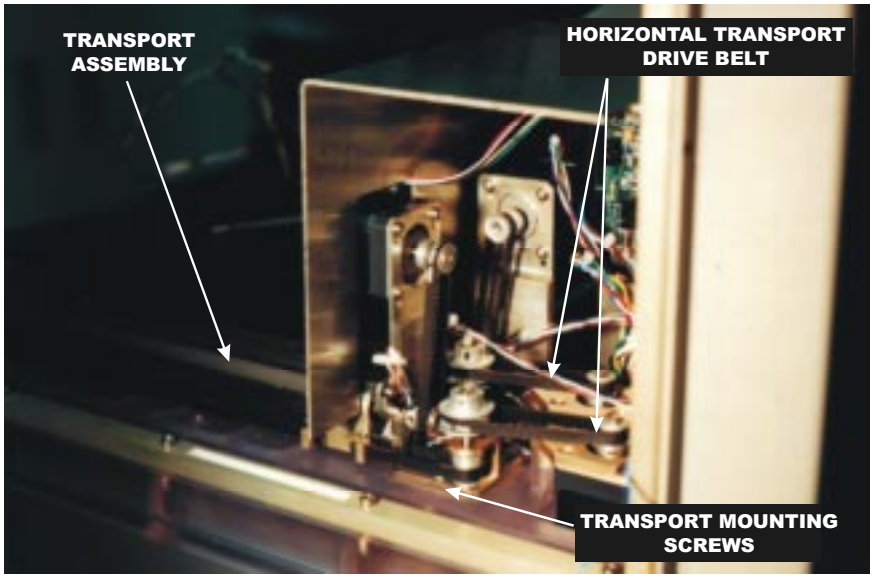


Figure 5-28a Transport Replacement (Motor End View)

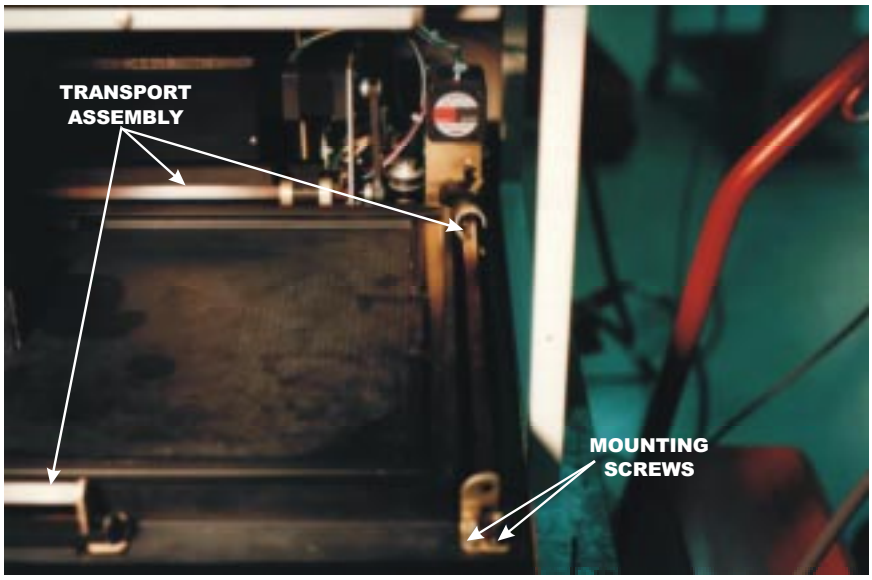


Figure 5-28b Transport Replacement (Opposite End View)

Transport Paddle Drive Belt

Refer to Figure 5-29 for the location of a transport paddle drive belt.

Removal

1. Open or remove the access cover(s) from the area that exposes the transport paddle drive belt you are replacing.
2. Removing the transport belt clamp by loosening the two screws securing the clamp to the hold and base carriage.
3. Count and note the number of teeth on the belt that are exposed past the hold and base carriage brackets. (Normally three on each exposed end.)
4. Remove and discard the drive belt.

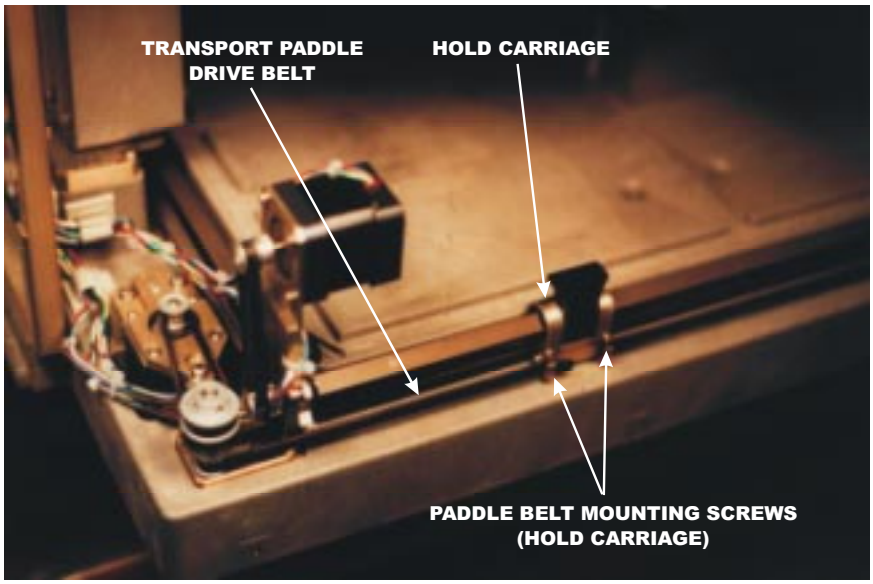


Figure 5-29 Paddle Belt Replacement

Installation

1. Thread the belt around the transport pulleys as noted during the removal. Ensure the belt teeth are positioned into the pulley grooves.
2. Place the ends over the hold carriage mounting. The number of exposed teeth should be the same as noted from the removal. (Rule of thumb: Each exposed end of the belt should have 3 belt teeth exposed. If belt too tight, decrease one tooth at a time.)
3. Install and tighten the transport belt clamp.
4. Install access doors or covers removed earlier.
5. Ensure the instrument is ready to be turned ON and verify the system operation.
6. Verify alignment (See Appendix E - Alignment Procedure.)

Incubator Assembly

The replacement procedure for the incubator assembly component parts are covered in this section. Removable and replacement parts of the incubator assembly consists of:

- 2 Carousel Fans
- Carousel Heater Assembly
- Carousel Quadrant

Removal and installation of the carousel motor and drive belt can be found in the Card Handing System section of this chapter.

Bottom Carousel Fan Replacement

Refer to Figure 5-30 for the location of the bottom fan.

Removal

1. Open the rear instrument cover and the rear access cover for the incubator to expose the heater fan.
2. Label and disconnect the fan cable from the SPN board. (Note the fan position.)
3. Remove the screws, flat washers, and lock washers attaching the bottom fan to the top incubator assembly.

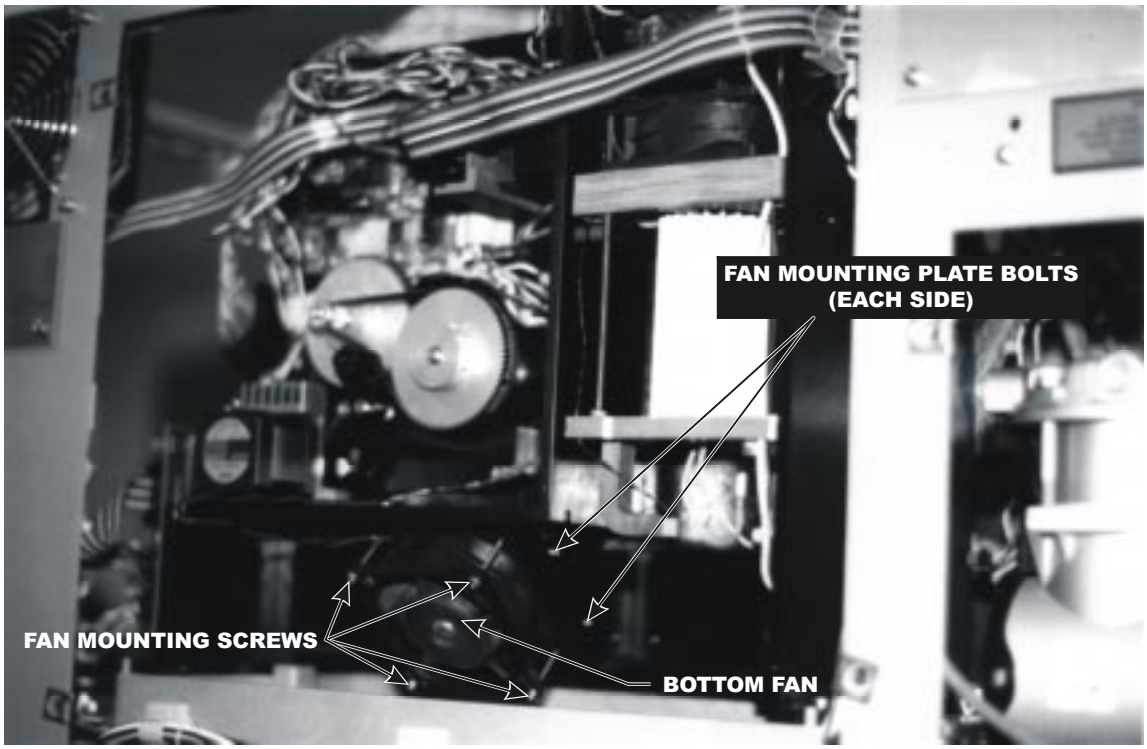


Figure 5-30 Bottom Carousel Fan Replacement

Installation

1. Place the fan into the incubator housing as noted from removal. (Air flow should be from outside the cabinet to inside the carousel.)
2. Install the lock washers, flat washers, and screws to attach the bottom fan to the incubator assembly.
3. Connect the fan cable to the SPN board.
4. Install the covers to the incubator/carousel area and the instrument covers. Ensure the instrument is ready to turn ON and verify fan is working.

Forthcoming Design Change

Figure 5-31 shows an example of the upcoming molded incubator assembly. The top carousel fan replacement will be easily achieved through the top access and the bottom fan through access from the back.

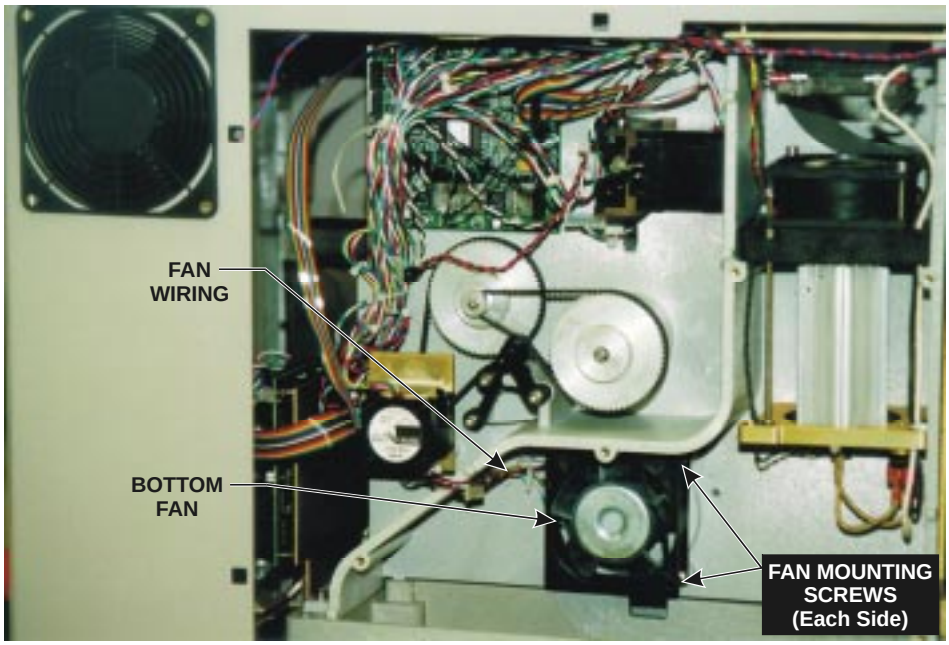


Figure 5-31 Molded Incubator Assembly

Carousel Heater Assembly Replacement

Refer to Figure 5-32 for the location of the carousel heater assembly.

Removal

1. Open the rear instrument cover and the incubator rear access cover to expose the heater assembly.
2. Tag and disconnect the wiring cables to the incubator heater.
3. Open the top right access cover to gain access to the carousel and remove the incubator access cover from the carousel.
4. Remove each quadrant (4) from the carousel per the Carousel Quadrant Removal procedure. Then turn the instrument OFF and disconnect the power.
5. Remove the left and right hockey table plate and corresponding hardware from inside incubator.
6. Locate and remove the screws, flat washers, and lock washers attaching the heater assembly to the carousel incubator housing.
7. Remove the heater assembly and set aside for return, repair or exchange.

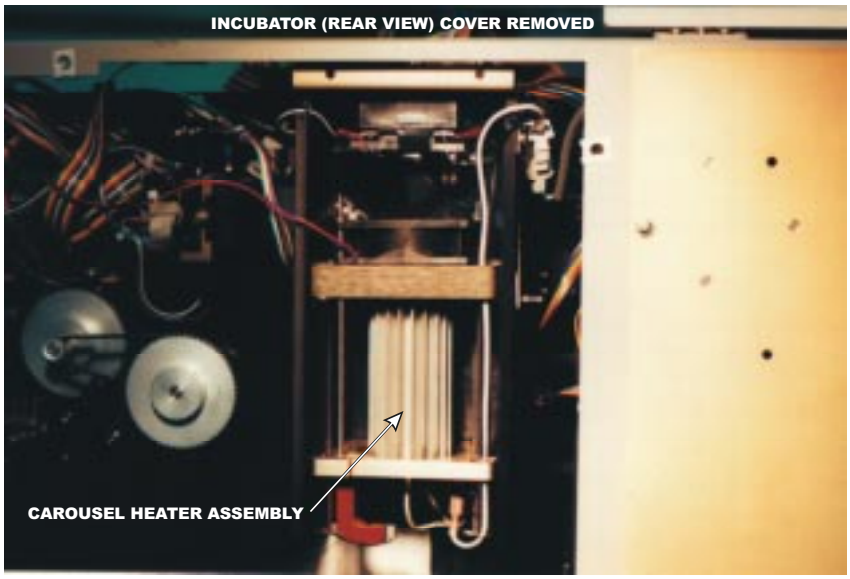


Figure 5-32 Carousel Heater Assembly Replacement

Installation

1. Place carousel heater assembly into position in the incubator. Be sure fan is positioned so that air flow is blowing downward across the heater into the carousel stack and that the power cable is positioned to the access area of the incubator chamber.
2. Install the lock washers, flat washers, and screws to attach the carousel heater assembly to the carousel incubator housing.
3. Install right and left hockey table plate to inside of incubator.
4. Reconnect the wiring cables to the heater assembly fan and install the back covers of the instrument removed during disassembly.

Power ON the instrument and continue with the Carousel Quadrant Installation Procedure.

Carousel Quadrant Removal/Replacement

NOTE: This procedure must be performed when no cards are being processed in the instrument.

Removal

1. From the Display Assembly's Main Menu select Utilities, Maintenance, Cleaning, Carousel Cleaning.
2. Select the option **remove a section**. After removing the Incubator Access Cover, follow the display as it steps you through the quadrant removal process.
3. The carousel quadrants are removed in four sections. Do so by gently pulling the quadrant to the right, and toward the front of the instrument when prompted.

Installation

1. While still in the Carousel Cleaning menu, select **replace a section**. Follow the display as it steps you through the quadrant replacement process.
2. To replace, grasp the carousel quadrant section and place the quadrant on the carousel hub. Align the notch to the spring loaded locking pin as shown in Figure 5-33.

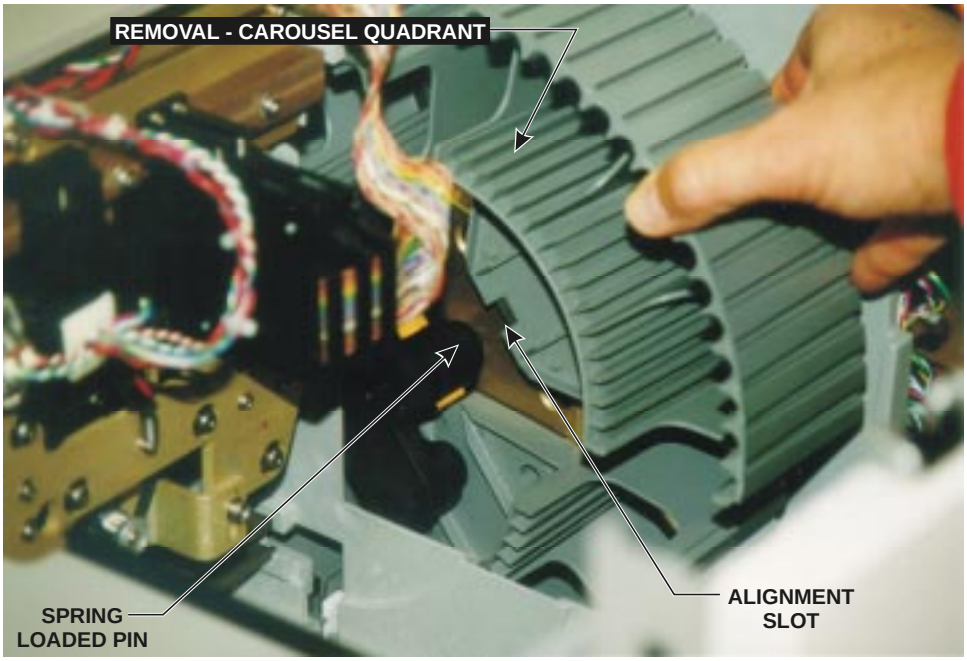


Figure 5-33 Carousel Quadrant Replacement

3. Position and push the quadrant section until the quadrant locks into place on the carousel hub spring loaded locking pin. (Figure 5-34).

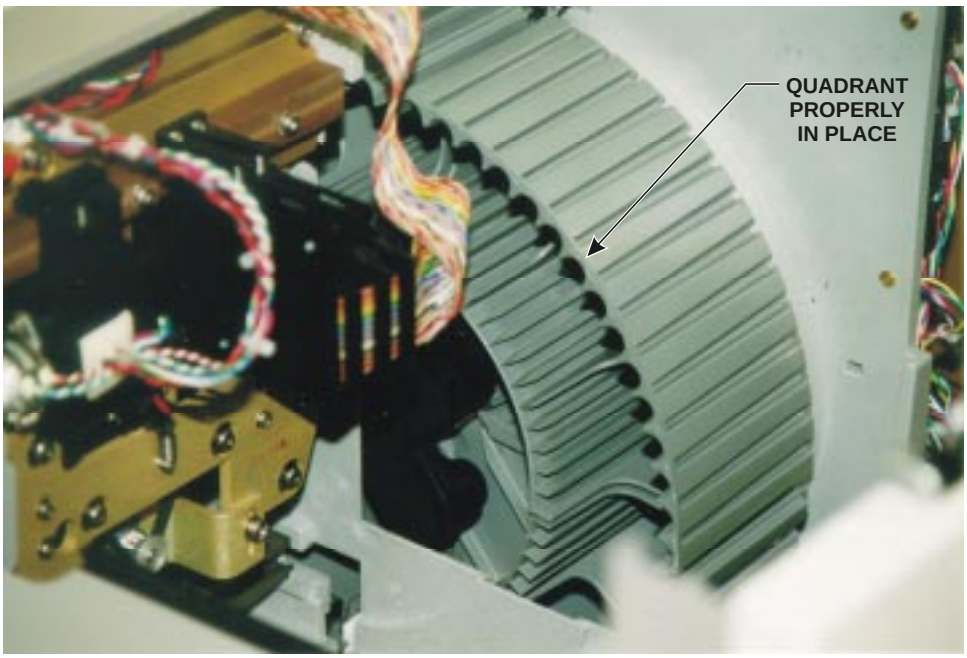


Figure 5-34 Carousel Quadrant Properly in Place

4. Install the Incubator Access Cover and close the instrument covers.

Optics System Component Replacement

The optics system component replacement procedures are written to allow you to make the required replacements as efficiently as possible. Each component of the optics system is not included in these procedures; however, the main items are covered in a simple and sequential step by step approach for the components that are field replaceable.

Transmittance (TX) Optics Replacement

Refer to Figure 5-35 for location of the TX optics.

Removal

1. Open the top covers of the instrument.
2. Disconnect the drain tube from the Diluter Cover and then unscrew and move the Diluter Cover (including the saline bag) to the side.
3. Tag and disconnect the ribbon cables that are plugged into both sides of the TX optics. (The Reader SPN board above the optics will need to be removed from the standoffs and pushed aside, allowing access to the emitter side of the TX optics.)
4. While supporting each of the optics modules, one at a time push the clamp lever on the top of each of the TX optics modules and the FL optics module. Gently allow the optics to hinge down.
5. Press on the belt where the optics sit and make a mental note of the belt tension. Also turn the motor shaft and pulley of the reader head motor and make a mental note of the force required to turn it by hand. (When re-assembling, the belt will need to be adjusted accordingly.)
6. Unscrew the three captive screws from the reader ledge and remove the ledge from the reader frame.
7. Note the placement of the timing belt on the reader head. Loosen the timing belt motor and push it upward, adding slack to the belt.
8. Remove the belt partially by pulling it over the upper right corner of the roller plate assembly. Then with the optics opened, maneuver the belt around and down so it comes off the TX optics (The belt will still be threaded around the fluorescence and the rest of the reader head.)
9. Close each of the optics modules until the clamp lever locks in place.
10. Remove the two mounting screws attaching the TX optics module(s) you need to replace from the reader head assembly.
11. Carefully slide the TX optics module(s) from the reader.
12. Set the optics module(s) aside to return for repairs or exchange.

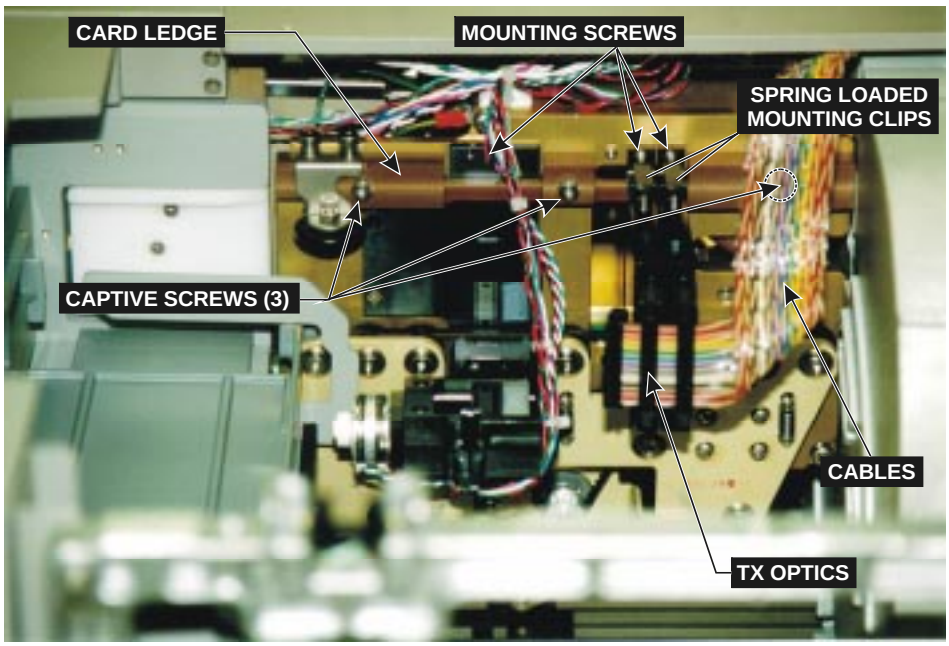


Figure 5-35 TX Optics Module Placement

Installation

1. Carefully install the TX optics module(s) into the reader head assembly. (Order is important. See Figure 5-35.)
2. Install the mounting screws attaching the optics module(s) to the frame.
3. While supporting each of the optics modules, one at a time push the clamp lever on the top of each of the TX optics modules and the FL optics module. Gently allow the optics to hinge down.
4. Manipulate the belt up and over the optics and reposition the belt around the roller plate assembly.
5. Install the reader ledge on to the frame and tighten the three captive screws.
6. Carefully close each of the optics modules until the clamp lever locks in place, ensuring the drive belt is in the proper position on the rollers.
7. Position and tighten the motor so the belt tension is the same as noted earlier. (Open the optics to check the belt tension and rotate the motor shaft and pulley checking the force required.)
8. Re-connect the flat cables to the TX optics and snap the Reader SPN board back onto the standoff posts.
9. Re-install the Diluter Cover (including the saline bag) and then re-connect the drain tube.
10. Close the top access doors.
11. Ensure the instrument is ready to be turned ON and verify the system operation.
12. After turning the ***VITEK•2®*** ON, from the Diagnostic window type **tx_test X** (X = the number of the Transmittance optics which has been replaced i.e. 1, 2 or 3). Verify that the test passed.

Fluorescence (FL) Auto-Cal Assembly Replacement

Figure 5-36 shows the location of the FL auto-cal assembly.

NOTE: The Fluorescence assembly must be replaced as a complete unit. Its parts should not be interchanged..

Removal

1. Open the top covers of the instrument. Disconnect the drain tube from the diluter cover and then unscrew and move the diluter cover (including the saline bag) to the side.
2. Tag and disconnect all FL auto-cal assembly wires attached to the Reader SPN board.
3. Unscrew the small phillips screw securing the auto-cal to the FL optics (under the FL hinge).
4. Carefully remove the FL auto-cal assembly from the FL optics.
5. Set the FL auto-cal assembly aside to return for repairs or exchange.

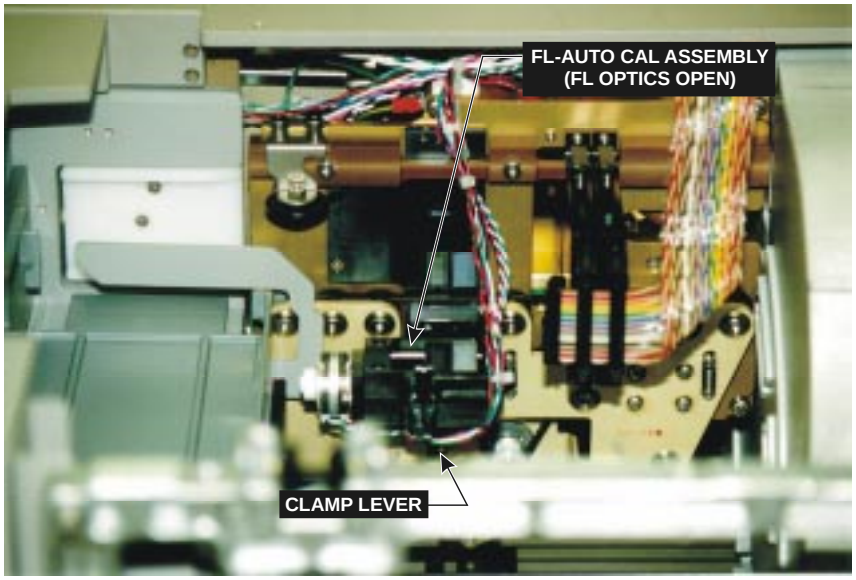


Figure 5-36 FL Auto-Cal Assembly

Installation

1. Carefully install the FL auto-cal assembly to the FL optics and then close module until the clamp lever locks in place.
2. Re-connect the wires from the FL auto-cal assembly to the Reader SPN board.
3. Close the top access doors.
4. Ensure the instrument is ready to be turned ON and verify the system operation.
5. After turning ***VITEK•2®*** ON, Align the FL auto-cal optical shuttle and perform Fluorescence Optics Calibration Procedure. (See Appendix E & F.)

Fluorescence (FL) Lamp Cassette Assembly Replacement

Refer to Figure 5-37 for the location of lamp cassette assembly.

NOTE: The Fluorescence assembly must be replaced as a complete unit. Its parts should not be interchanged..

Removal

1. Open the top covers of the instrument. Disconnect the drain tube from the diluter cover and then unscrew and move the diluter cover (including the saline bag) to the side.
2. The lamp cassette assembly is installed in the lamp power supply assembly.
3. Locate the one captive and two mounting screws for the lamp assembly and loosen.
4. Using the handle, pull the lamp assembly straight up. The lamp assembly will slide up a dovetailed mounting on the FL optics module.
5. Set the lamp cassette assembly aside to return for repair or replacement.

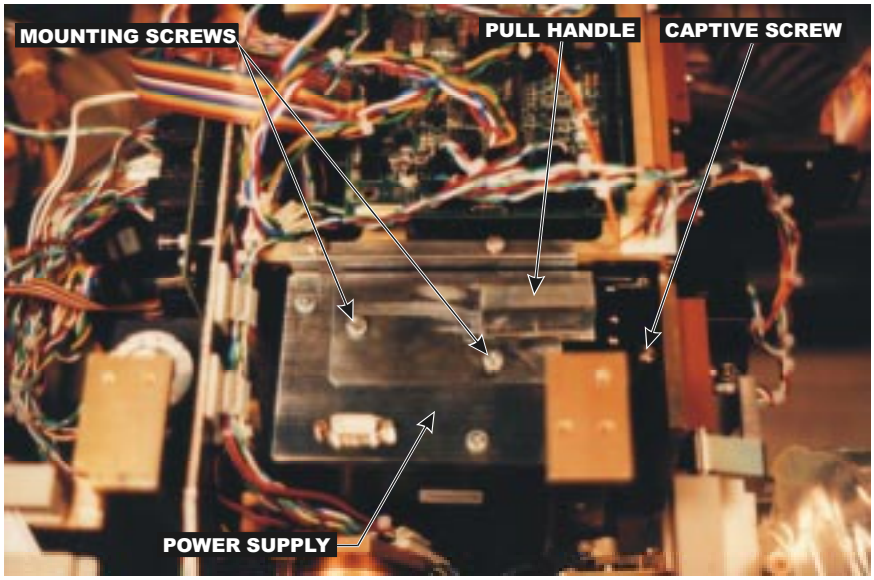


Figure 5-37 Fluorescence (FL) Lamp Assembly Cassette Replacement

Installation

1. Carefully align the dovetail groove on the lamp assembly to the dovetail mount on the FL optics module. Slide the lamp assembly down until it is flush with the power supply case.
2. Tighten the captive and mounting screws to secure the lamp assembly.
3. Re-install the Diluter Cover (including the saline bag) & reconnect the drain tube.
4. Close the top access doors that were opened earlier.
5. Ensure the instrument is ready to be turned ON and verify the system operation.
6. From the diagnostics prompt type **$FL_TOTAL_FLASHES=0**, to reset the flash counter for the new lamp.
7. After turning the ***VITEK•2®*** instrument ON, perform Fluorescence Optics Calibration Procedure. (See Appendix F.)

Fluorescence (FL) Peak Detector Assembly Replacement

Figure 5-38a shows the locations of the FL optics components for replacement. Figure 5-38b and Figure 5-38c shows the location of the peak detector and it removed from the instrument.

NOTE: The Fluorescence assembly must be replaced as a complete unit. Its parts should not be interchanged..

Removal

1. Open the top covers of the instrument. Disconnect the drain tube from the Diluter Cover and then unscrew and move the Diluter Cover (including the saline bag) to the side.
2. Perform the FL Auto-Cal Assembly Replacement *Removal* Procedure, Steps 2-4 and set the auto-cal assembly aside.
3. Perform the FL Lamp Cassette Assembly Replacement *Removal* Procedure, Steps 2-4 and set the lamp assembly aside.
4. While supporting each of the optics modules, push the clamp levers on the top of each of the TX optics modules. Gently allow the optics to hinge down.
5. Press on the belt where the optics sit and make a mental note of the belt tension. Also turn the motor shaft and pulley of the reader head motor and make a mental note of the force required to turn it by hand. (When re-assembling, the belt will need to be adjusted accordingly.)
6. Unscrew the three captive screws from the reader ledge and remove the ledge from the reader frame.
7. Close the TX optics modules until the clamp levers lock in place.
8. Note the placement of the timing belt on the reader head. Loosen the timing belt motor and push it upward, adding slack to the belt.
9. Disconnect the peak detector ribbon cable from the head controller board. Also disconnect the peak detector ground cable from the card reader frame.
10. Remove the three mounting screws attaching the peak detector assembly to the card reader frame.
11. Carefully slide the peak detector and the peak detector cable from the reader optics frame.
12. Set the FL modules aside to return for repairs or exchange.

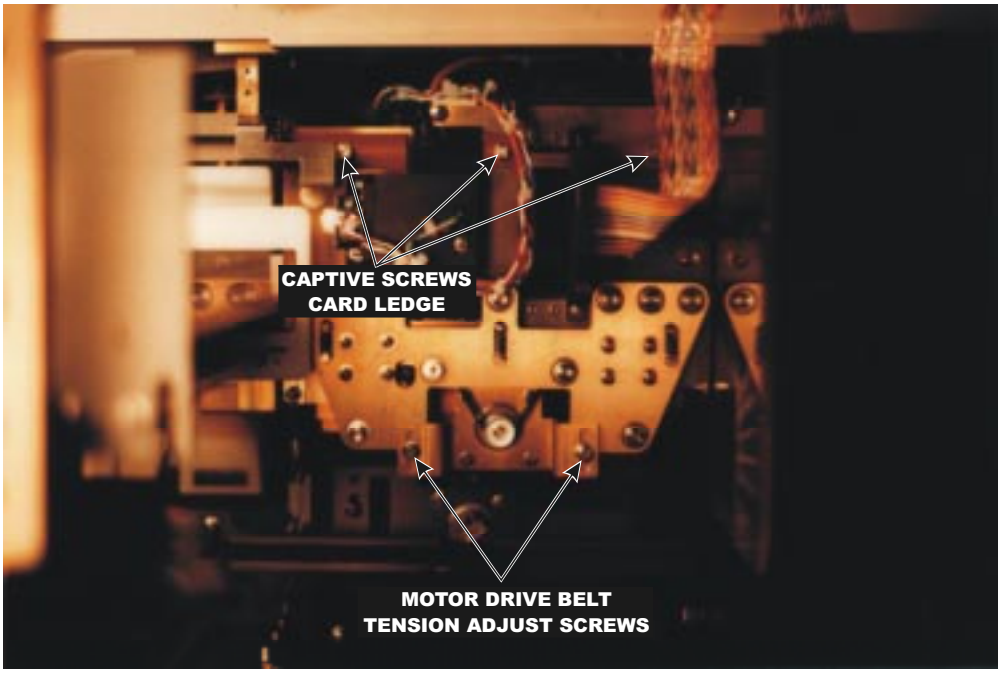


Figure 5-38a Fl Optics Component Locations

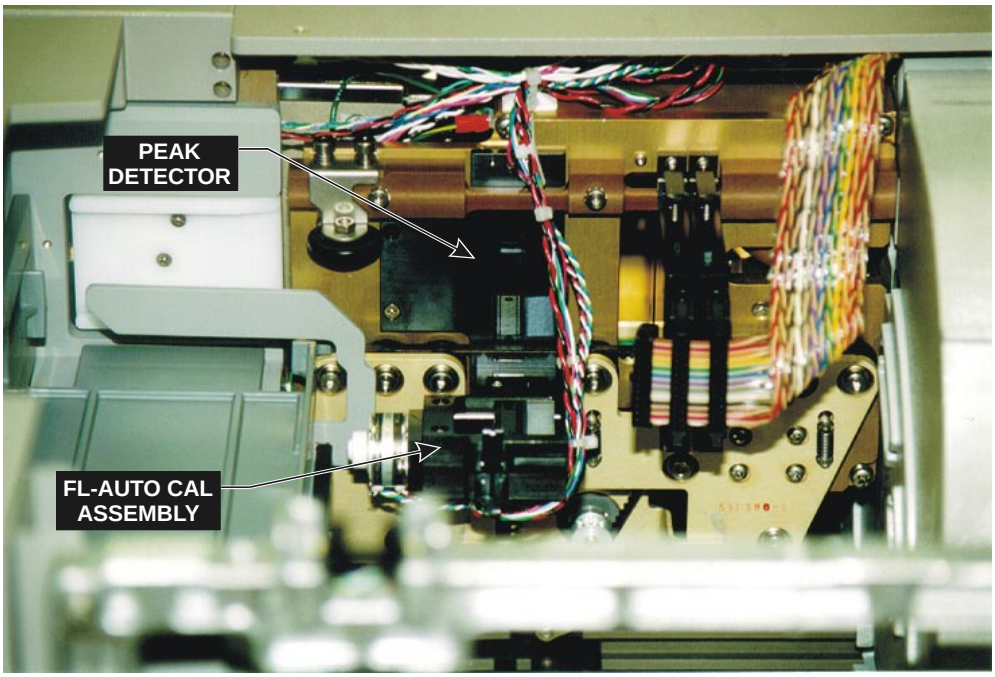


Figure 5-38b Peak Detector Location

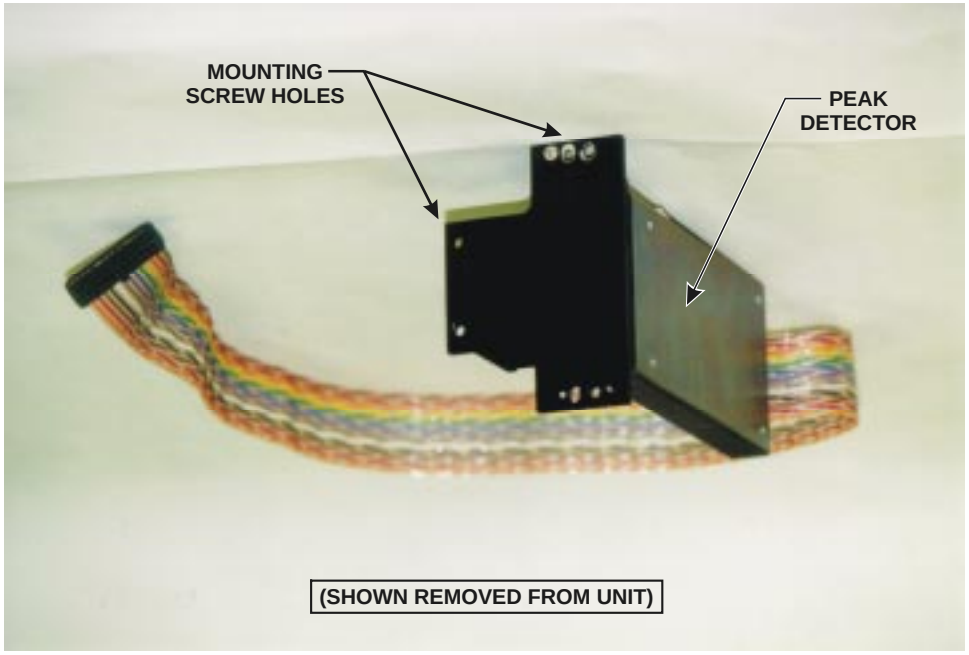


Figure 5-38c Peak Detector Assembly (Removed)

Installation

1. Carefully install the peak detector assembly into the reader optics frame while routing the peak detector ribbon cable.
2. Install the mounting screws attaching the peak detector assembly to the frame.
3. Connect the peak detector ribbon cable to the head controller board. Also connect the peak detector ground cable to the card reader frame.
4. Install the reader ledge on the frame and tighten the three captive screws.
5. Ensuring the drive belt is in the proper position on the rollers, position and tighten the motor so the belt tension is the same as noted earlier. (Open the optics to check the belt tension and rotate the motor shaft and pulley checking the force required.)
6. Perform Steps 1 and 2 of the Fluorescence Lamp Cassette Assembly Replacement *Installation* Procedure.
7. Perform Steps 1 and 2 of the Fluorescence Auto-Cal Assembly Replacement *Installation Procedure*.
8. Re-install the Diluter Cover (including the saline bag) and then re-connect the drain tube.
9. Close the top access doors.
10. Ensure the instrument is ready to be turned ON and verify the system operation.
11. If a new lamp was installed, type **$FL_TOTAL_FLASHES=0** at the diagnostics prompt.
12. After turning the ***VITEK•2®*** instrument ON, perform Fluorescence Optics Calibration Procedure. (See Appendix F.)

Lamp Power Supply Assembly Replacement

Refer to Figure 5-39 for the location of the reader lamp power supply.

NOTE: The Fluorescence assembly must be replaced as a complete unit. Its parts should not be interchanged..

Removal

1. Open the top covers of the instrument. Disconnect the drain tube from the Diluter Cover and then unscrew and move the Diluter Cover (including the saline bag) to the side.
2. Perform the FL Lamp Cassette Assembly Replacement *Removal* Procedure, Steps 2-4 and set the lamp assembly aside.
3. Tag and disconnect the wiring cables for the Lamp Power Supply Assembly.
4. Remove the two mounting screws on the top of the power supply assembly.
5. Loosen the bottom right screw of power supply assembly. (Do not remove the screw).
6. Gently lift the power supply from the reader.
7. Set the power supply aside to return for repairs or exchange.

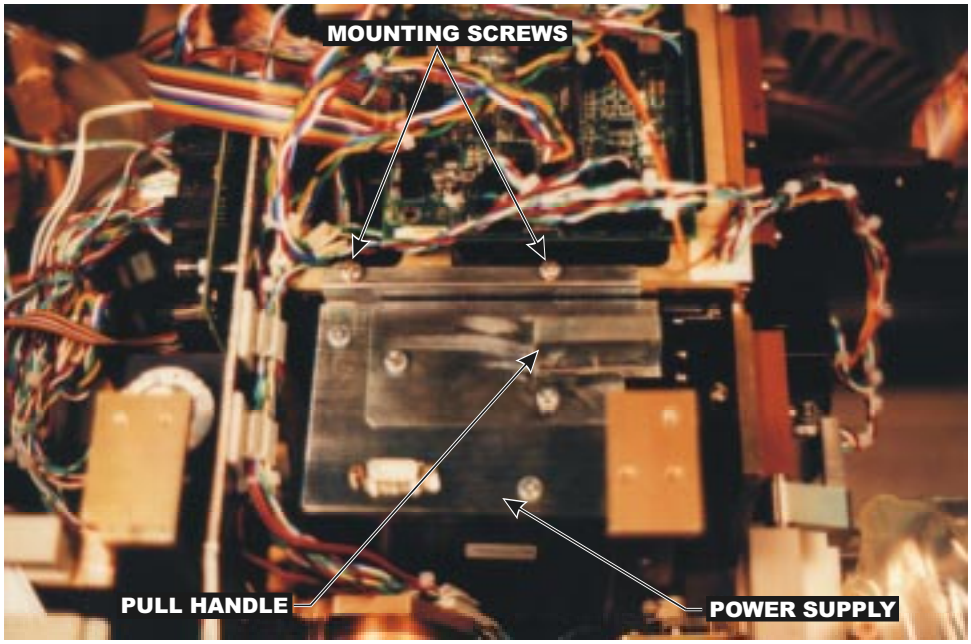


Figure 5-39 Lamp Power Supply Replacement

Installation

1. Place the power supply into the reader frame. The power supply flange slot should slide onto the loosened pan head screw.
2. Install the two top mounting screws to secure the power supply to the reader frame. Then tighten the bottom right screw.
3. Connect all wiring cables disconnected during removal of the power supply.
4. Perform Steps 1 and 2 of the Fluorescence Lamp Cassette Assembly Replacement *Installation* Procedure.
5. Re-install the Diluter Cover (including the saline bag) and then re-connect the drain tube.
6. Close the top access doors that were opened earlier.
7. Ensure the instrument is ready to be turned ON and verify the system operation.
8. After turning the ***VITEK•2®*** instrument ON, perform Fluorescence Optics Calibration Procedure. (See Appendix F.)

Reader Head Assembly Replacement

Refer to Figure 5-40 for the location of the Reader Head Assembly captive screws.

Removal

1. Open the top covers of the instrument. Disconnect the drain tube from the Diluter Cover and then unscrew and move the Diluter Cover (including the saline bag) to the side.
2. Tag and disconnect all wires and cables from the Reader Assembly that are connected to the Head Controller Board.
3. Tag and disconnect all wires and cables from the Reader SPN board that are going to another location.
4. Carefully pry the Reader SPN board from the standoffs and push the board aside, allowing access to the two captive screws.
5. Perform the FL Lamp Cassette Assembly Replacement *Removal* Procedure, Steps 2-4 and set the lamp assembly aside to install in new reader head assembly.
6. Perform Lamp Power Supply Replacement *Removal* Procedure, Steps 3-6 and set the power supply aside to install in new reader head assembly.
7. Loosen the two captive screws on the base of the reader frame.
8. Gently lift the reader assembly from the instrument and set on a flat table top surface.
9. Perform the TX Optics Replacement *Removal* Procedure, Steps 4-11 and set the TX optics aside to install in new reader head assembly.
10. Perform the FL Auto-Cal Assembly Replacement *Removal* Procedure, Steps 2-4 and set the auto-cal assembly aside to install in new reader head assembly.
11. Perform the FL Optics Peak Detector Assembly Replacement *Removal* Procedure, Steps 9-10 and set the FL optics and peak detector aside to install in new reader head assembly.
12. Using a chip extractor, remove the SPN chip from the Reader SPN board and set the chip aside to install in the new reader head assembly. (NOTE: Use anti-static precautions.)
13. Set aside the reader assembly to be returned for exchange or repair (if required).

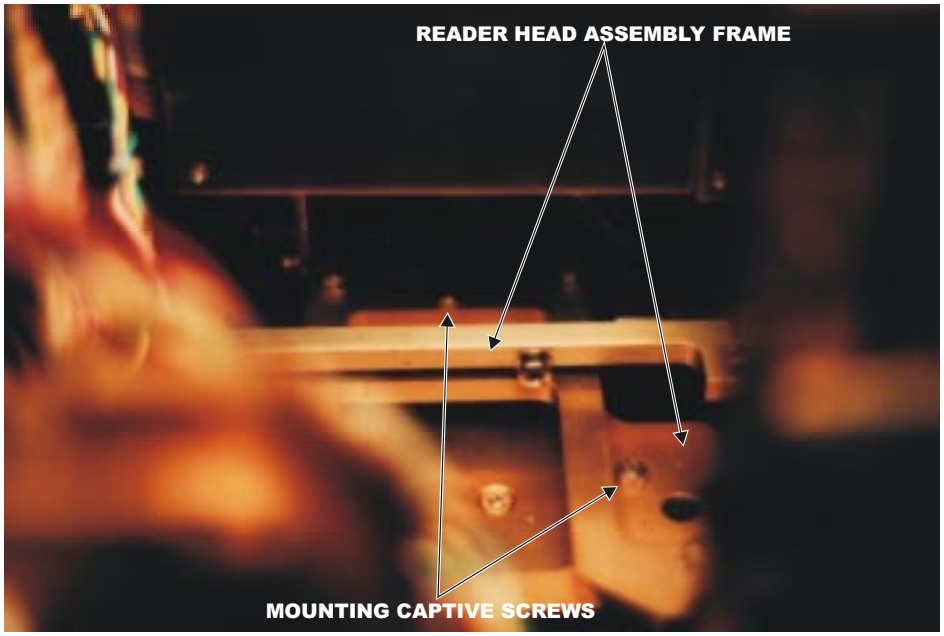


Figure 5-40 Reader Head Assembly Captive Screws (Located Inside Reader Head)

Installation

1. Match the flat corner of the SPN chip pulled from the old reader head assembly with the flat spot on the Reader SPN board socket of the replacement reader head and snap it in place. (NOTE: Use anti-static precautions.)
2. Perform Steps 1 and 2 of the FL Optics Peak Detector Assembly Replacement *Installation* Procedure.
3. Perform Steps 1 and 2 of the FL Auto-Cal Assembly Replacement *Installation* Procedure.
4. Perform Steps 1-7 of the TX Optics Replacement *Installation* Procedure.
5. Carefully place the reader head assembly into the instrument and mechanically align the reader head to the carousel and stacker.
6. Tighten the two captives screws to secure the reader head assembly in the instrument.
7. Perform Steps 1-3 of the Lamp Power Supply Replacement *Installation* Procedure.
8. Perform Steps 1 and 2 of the FL Lamp Cassette Assembly Replacement *Installation* Procedure.
9. Connect all wiring cables disconnected from the removal and install the Reader SPN board on the standoffs.
10. Re-install the Diluter Cover (including the saline bag) and then re-connect the drain tube.
11. Close the top access doors.
12. Ensure the instrument is ready to be turned ON and verify the system operation.
13. After turning the ***VITEK•2®*** instrument ON, perform Alignments and Fluorescence Optics Calibration. (See Appendix E & F.)

Reader Head Assembly Drive Belt Replacement

Drive belt replacement can be accomplished without removing the reader assembly from the instrument. Refer to Figure 5-41 for the location of the reader head drive belt.

Removal

1. Perform the Fluorescence Auto-Cal Assembly Replacement *Removal* Procedure, Steps 2 through 5.
2. Tag and disconnect the accessible ribbon cable plugged into the TX optics.
3. While supporting each of the optics modules, one at a time push the clamp lever on the top of each of the TX optics modules. Gently allow the optics to hinge down.
4. Press on the belt where the optics sit and make a mental note of the belt tension. Also turn the motor shaft and pulley of the reader head motor and make a mental note of the force required to turn it by hand. (When re-assembling, the belt will need to be adjusted accordingly.)
5. Note the placement of the timing belt on the reader head. Loosen and remove the drive motor mount bracket screws, slip the belt off of the drive pulley and set the motor assembly aside.
6. Remove the belt partially by pulling it over the upper right corner of the roller plate assembly. Then with the optics opened, maneuver the belt around and down so it comes off the TX optics.
7. Remove the belt from the Reader Head Assembly.

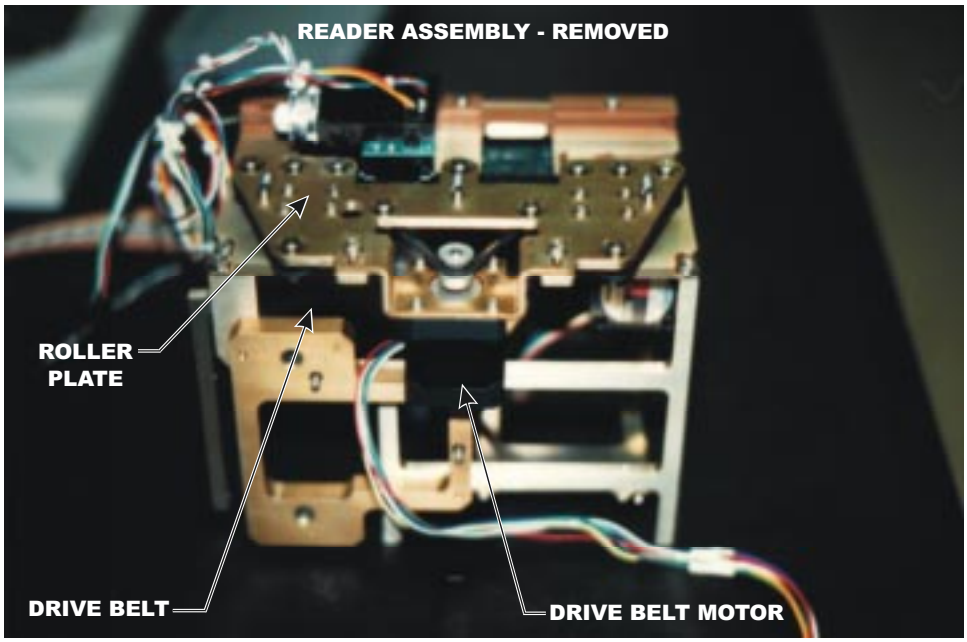


Figure 5-41 Reader Head Assembly Drive Belt Replacement

Installation

1. Install the belt on the card reader assembly as noted from the removal.
2. Manipulate the belt up and over the optics and reposition the belt around the roller plate assembly.
3. Carefully close each of the optics modules until the clamp lever locks in place and reconnect the ribbon cable.
4. Install the motor and mount bracket assembly with the mounting screws. Do not tighten the screws.
5. Place the drive belt over the drive motor pulley. Slide the motor and mount to remove the slack in the drive belt.
6. Position and tighten the motor so the belt tension is the same as noted earlier. (Open the optics to check the belt tension and rotate the motor shaft and pulley checking the force required.)
7. Perform the Fluorescence Auto-Cal Assembly Replacement *Installation* Procedure, Steps 1 and 2.

Reader Head Roller Plate Assembly Replacement

The roller plate replacement can be accomplished without removing the reader assembly from the instrument. Bad bearings would create the need for replacing the roller plate assembly. Refer to Figure 5-41 for location of the roller plate.

Removal

1. Tag and disconnect the accessible ribbon cable plugged into the TX optics.
2. While supporting each of the optics modules, one at a time push the clamp lever on the top of each of the TX optics modules and the FL optics module. Gently allow the optics to hinge down.
3. Press on the belt where the optics sit and make a mental note of the belt tension. Also turn the motor shaft and pulley of the reader head motor and make a mental note of the force required to turn it by hand. (When re-assembling, the belt will need to be adjusted accordingly.)
4. Close each of the optics modules until the clamp levers lock in place.
5. Note the placement of the timing belt on the reader head. Loosen and remove the screws securing the reader motor bracket to the roller plate assembly.
6. Remove the eight screws securing the roller plate assembly.
7. Remove the three springs.
8. Carefully remove the plate assembly from the reader head. (Take care not to allow linear way rails to drop.)
9. Carefully remove linear way rails by sliding them off of the reader head assembly. (NOTE: Ball bearings in linear way rails have minimal retainers. Extreme caution should be used, otherwise bearings will fall out.) See Figure 5-42 for direction of proper removal.
10. Remove the seven card rollers and the four reader belt rollers from the plate assembly.
11. Discard plate assembly.

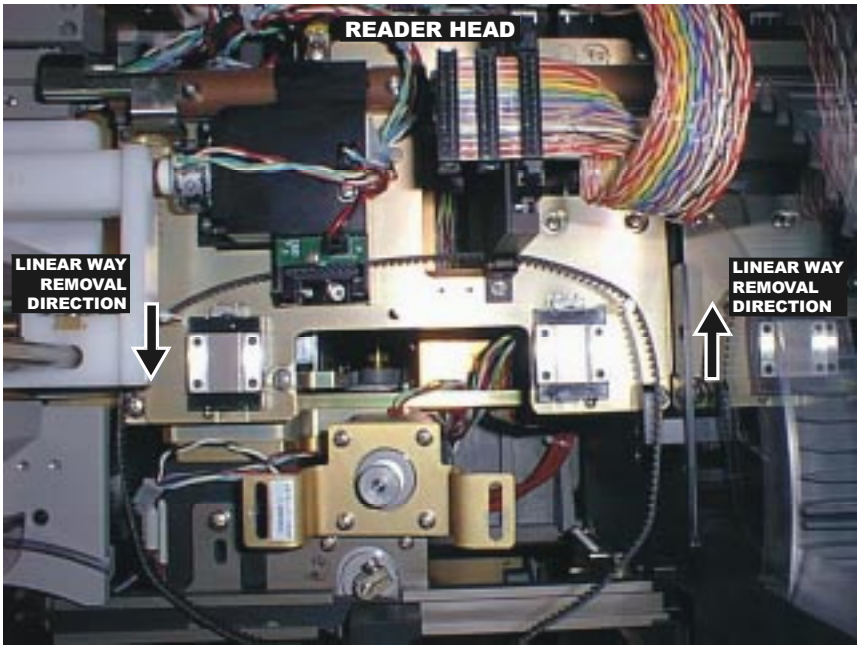


Figure 5-42 Reader Head with plate assembly removed (Linear way removal direction.)

Installation

1. Using thread locking adhesive on the shoulder screws, install the seven card rollers along the top of the plate assembly and the four reader belt rollers on the remaining bearings. Tighten securely.
2. Carefully install the linear way rails the opposite direction from removal.
3. Carefully install the plate assembly while routing the timing belt as previously noted around the rollers.
4. Install the eight screws, but do not tighten.
5. Install the three springs.
6. Tighten the eight screws securing the plate assembly to the linear way rails.
7. While supporting each of the optics modules, one at a time push the clamp lever on the top of each of the TX optics modules. Gently allow the optics to hinge down.
8. Manipulate the belt up and over the optics and reposition the belt around the roller plate assembly.
9. Carefully close each of the optics modules until the clamp lever locks in place, ensuring the drive belt is in the proper position on the rollers.
10. Install the reader motor bracket to the roller plate assembly and place the timing belt around the pulley.
11. Position and tighten the motor so the belt tension is the same as noted earlier. (Open the optics to check the belt tension and rotate the motor shaft and pulley checking the force required.)
12. Reconncet the TX optics ribbon cable.

Air Pump Replacement

See Figure 5-43a and Figure 5-43b for the air pump location.

Removal

1. Open the top access doors of the instrument.
2. Disconnect the drain tube from the Diluter Cover and then unscrew and move the Diluter Cover (including the saline bag) to the side.
3. Tag and disconnect the cables and tubing attached to the air pump.
4. Note the mounting position of the pump and remove the screws and lock washers holding the pump into place. (Note pump bracket can be loosened and turned such that the pump can easily be removed.)
5. Remove the pump.

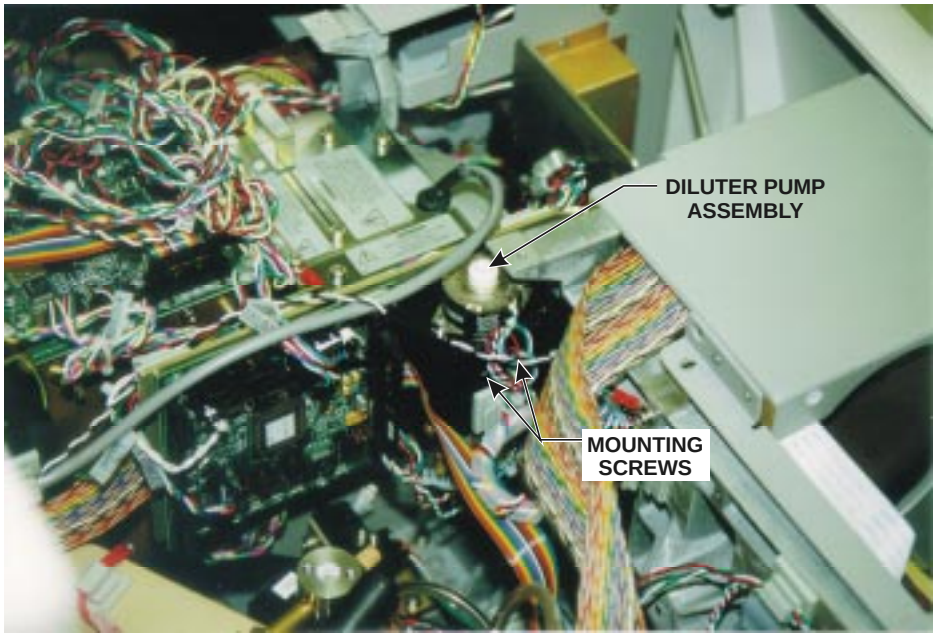


Figure 5-43a Air Pump Location

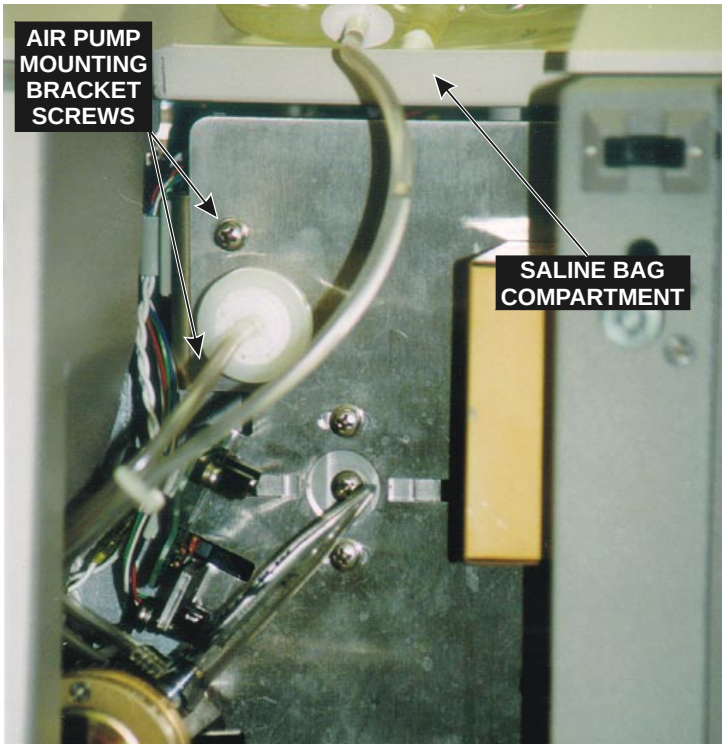


Figure 5-43b Air Pump Mounting Location

Installation

1. Place pump into the proper position noted from the removal of the old pump and install the mounting screws and lock washers.
2. Connect the cables and plastic tubing to the pump as tagged from the removal of the old pump.
3. Re-install the Diluter Cover (including the saline bag) and then re-connect the drain tube.
4. Close the top access doors.
5. Ensure the instrument is ready to turn ON and verify proper operation.
6. Perform Alignments (See Appendix E - Alignment Procedure.)

Diluter Dispenser Assembly Replacement

The design of the instrument permits the user to remove and install the complete dispenser assembly if problems are noted. This design makes for efficient change-outs.

NOTE: Take care not to contaminate disposable.

Refer to Figure 5-44a and Figure 5-44b for the dispenser assembly when performing the replacement procedures.

Removal

1. Open the top access doors of the instrument.
2. Disconnect the drain tube from the Diluter Cover. Unscrew the diluter cover, disconnect the dispensing tube and filter from the dispenser assembly and then move the diluter cover (including the dispensing tube and saline bag) to the side.
3. Tag and disconnect all wires and cables from the diluter SPN board that are going to another location other than the diluter dispenser assembly.
4. Tag and disconnect all plastic tubing associated with the dispenser assembly.
5. Supporting the dispenser assembly, remove the two mountiing screws holding the dispenser assembly to the instrument frame. (Refer to Figure 5-44a and 5-44b for the location of screws.)
6. Carefully maneuver the dispenser assembly, with the pump attached out of the instrument. If the pump makes it difficult to remove the dispenser, remove the mounting screws for the pump and bring both assemblies out individually.
7. Carefully maneuver the dispenser assembly out of the instrument.
8. Set the dispenser assembly aside to return for repairs or exchange.

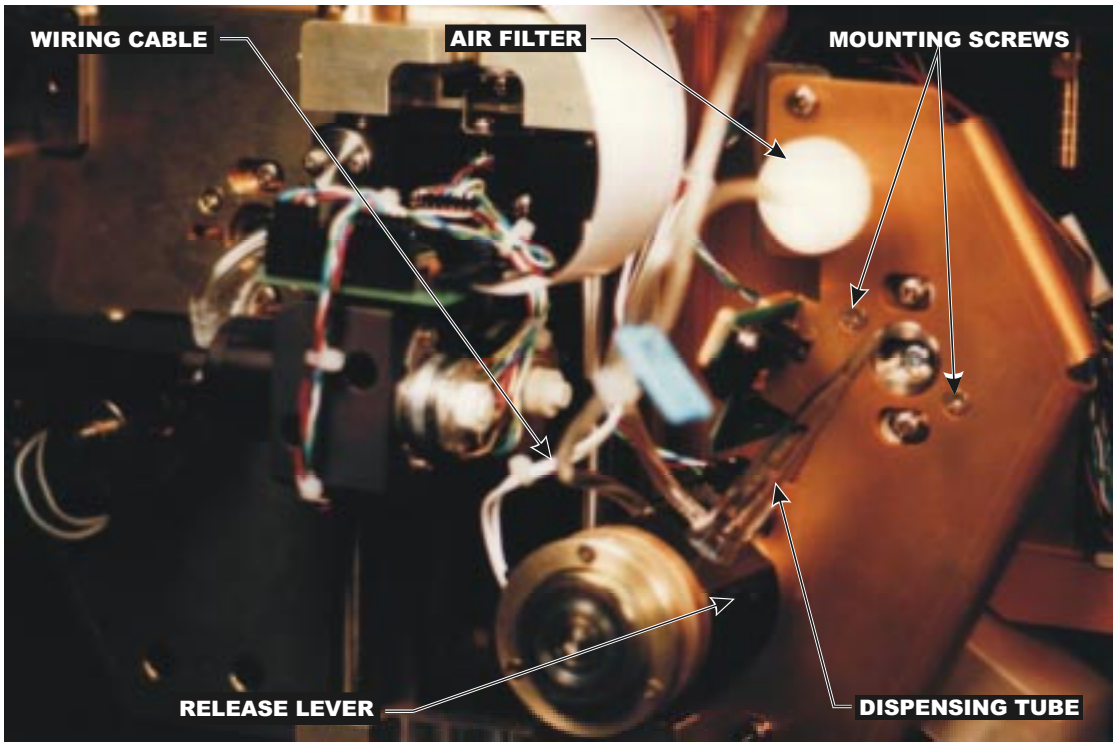


Figure 5-44a Dispenser Assembly Location (old design)

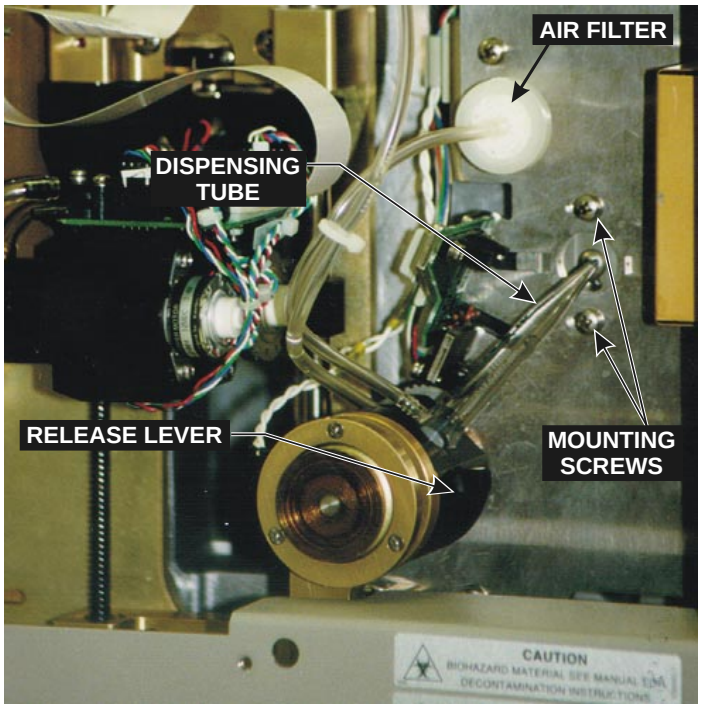


Figure 5-44b Dispenser Assembly Location (new design)

Installation

1. Carefully install the dispenser assembly into the instrument and install the mounting screws to secure the assembly to the frame. If the air pump was removed, install the air pump and secure it with the mounting screws.
2. Connect the plastic tubing, wiring cables and connectors as noted from the removal.
3. Install the saline bag compartment and saline bag as noted during removal.
4. Install the dispensing tube into the dispenser assembly.
5. Close the top and front access doors.
6. Ensure the instrument is ready to be turned ON and verify the system operation.
7. After turning the ***VITEK•2®*** instrument ON, perform Alignments (See Appendix E - Alignment Procedure.)

Pipettor Assembly Replacement

The design of the instrument permits the user to remove and install the complete pipettor assembly if problems are noted. This design makes for efficient change-outs. Refer to Figure 5-45 for the pipettor assembly when performing the replacement procedure.

NOTE: Take care not to contaminate disposable.

Removal

1. Open the top covers of the instrument. Disconnect the drain tube from the Diluter Cover and then unscrew and move the Diluter Cover (including the saline bag) to the side.
2. Tag and disconnect the flat ribbon network cable for the pipettor assembly where attached to the pipettor SPN board.
3. Remove the drum from the instrument. (Only empty the drum of all pipette tips if the drum needs to be replaced.)
4. Perform the Display Assembly *Removal* Procedure, Steps 3-5 and set the display assembly aside.
5. Supporting the pipettor assembly, remove the mounting screws holding the pipettor assembly to the instrument frame. (Refer to Figure 5-45a and 5-45b for the location of the screws.)
6. Carefully maneuver the pipettor assembly off of the guide post and then out of the instrument.
7. Set the pipettor assembly aside to return for repairs or exchange.

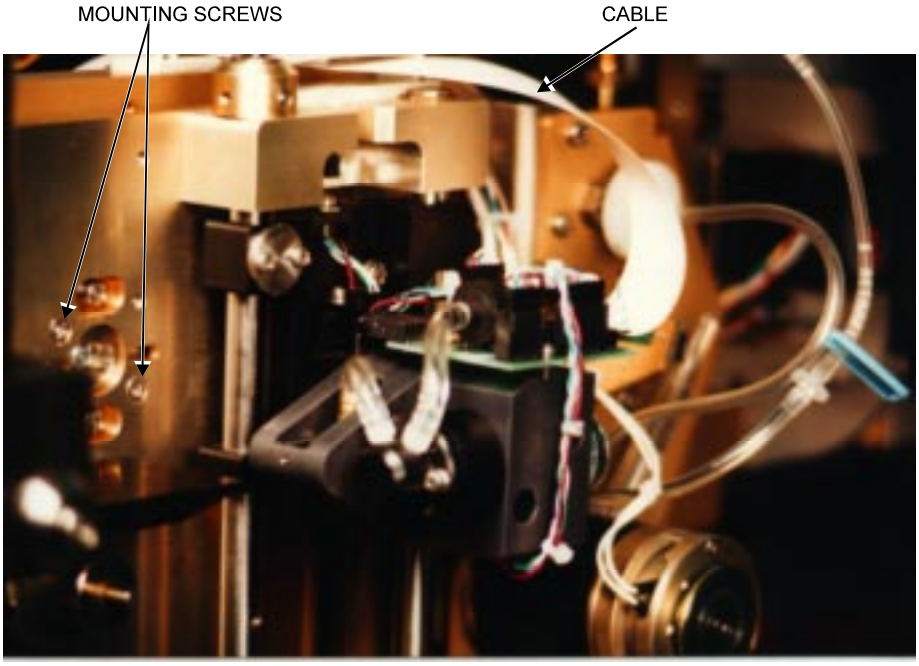


Figure 5-45a Pipettor Assembly Location (old design)

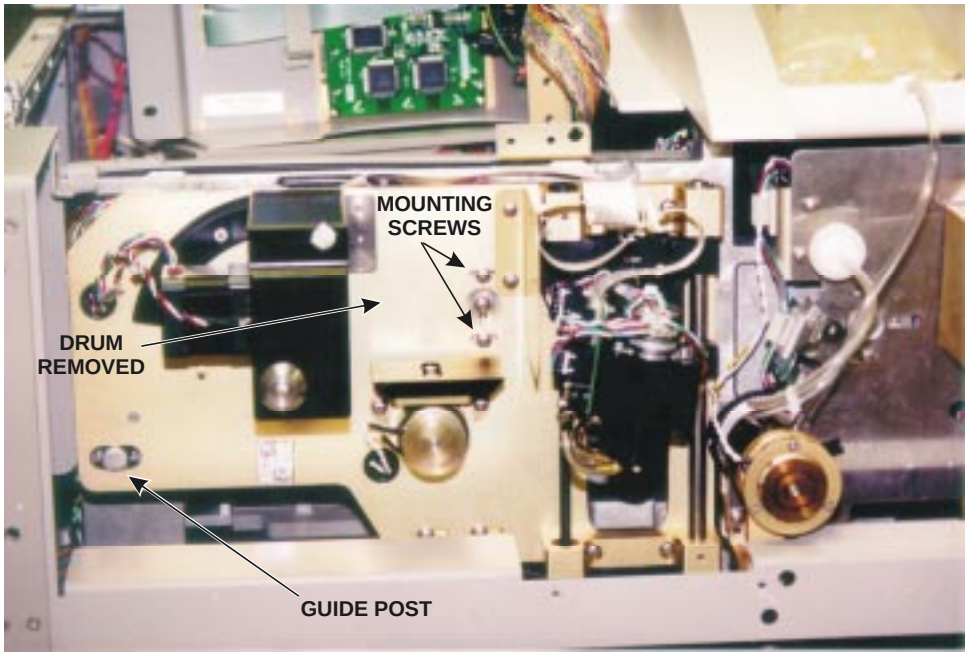


Figure 5-45b Pipettor Assembly Location (new design)

Installation

1. Carefully install the pipettor assembly into the instrument and install the mounting screws to secure the assembly to the frame.
2. Connect the flat ribbon network cable to the SPN / Board and clips as noted from the removal.
3. Perform the Display Assembly *Installation* Procedure, Steps 1-3.
4. Re-install the Diluter Cover (including the saline bag) and then re-connect the drain tube.
5. Close the top access doors.
6. Ensure the instrument is ready to be turned ON and verify the system operation.
7. After turning the ***VITEK•2®*** instrument ON, perform Alignments (See Appendix E - Alignment Procedure.)

Vacuum Chamber Assembly Replacement

Refer to Figure 5-46a for the location of the vacuum chamber assembly. Figure 5-46b shows a close-up view of the column assembly and slotted screws from the area circled on Figure 5-46a.

Removal

1. Open the top covers of the instrument. Disconnect the drain tube from the Diluter Cover and then unscrew and move the Diluter Cover (including the saline bag) to the side. Do not disconnect the bag.
2. Remove the left end panel of the instrument to gain access to the vacuum chamber assembly.

3. Tag and disconnect all wires and cables for the vacuum chamber assembly where attached to the left transport SPN board and DC Power Supply Board.
4. Tag and disconnect all wires and cables from the Vacuum/Sealer SPN board that are going to another location other than the diluter dispenser assembly.
5. Tag and disconnect the vacuum tubing from the vacuum chamber to the vacuum pump.
6. Loosen the two slotted screws on each vertical support of the vacuum chamber frame.
7. Gently lift the vacuum chamber assembly from the instrument and set on a flat table top surface.
8. Set the vacuum chamber assembly aside to be returned for exchange or repair (if required).

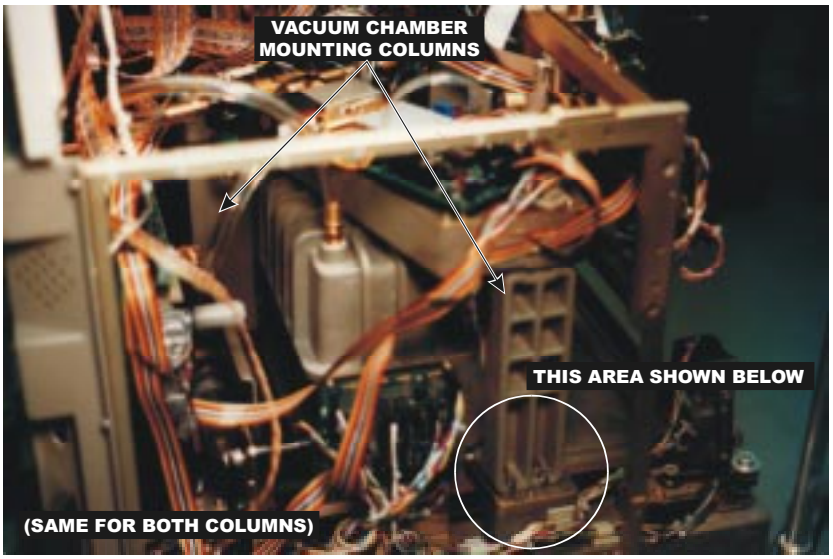


Figure 5-46a Vacuum Chamber Assembly

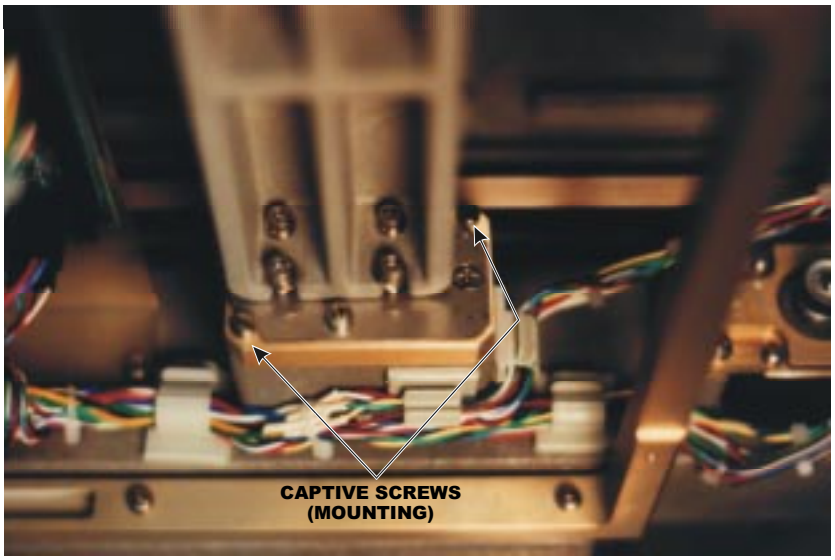


Figure 5-46b Vacuum Chamber Assembly Column

Installation

1. Carefully place the vacuum chamber assembly into the instrument.
2. Tighten the two slotted screws on each vertical support to secure the vacuum chamber assembly in the instrument.
3. Connect all wiring cables and vacuum tubing disconnected from the removal.
4. Install the left side access cover on the instrument.
5. Re-install the Diluter Cover (including the saline bag) and then re-connect the drain tube.
6. Close the top access doors.
7. Ensure the instrument is ready to be turned ON and verify the system operation.
8. After turning the ***VITEK•2®*** instrument ON, perform Alignments (See Appendix E - Alignment Procedure.)

Filler Valve Assembly Replacement

Refer to Figure 5-47 for the location of the filler valve assembly.

Removal

1. Open the top left cover of the instrument.
2. Tag and disconnect the wires for the corresponding valves, where attached to the circuit boards.
3. Note the positioning of the various fittings and piping components.
4. Disconnect the two large vacuum tubes from the valve assembly.
5. Remove the two mounting screws and then remove the valve assembly.
6. Set the valve assembly aside to be returned for exchange or repair (if required).

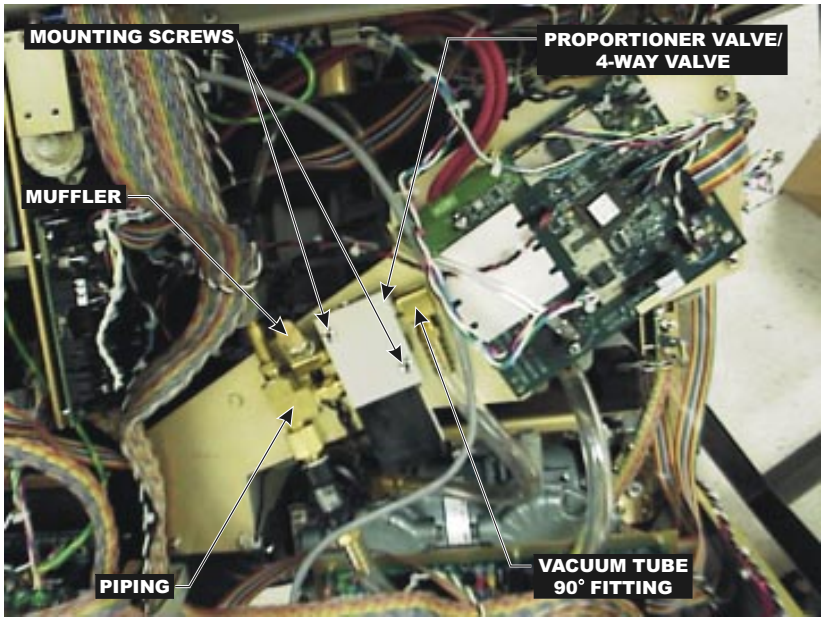


Figure 5-47 Filler Valve Assembly

Installation

1. Connect the two large vacuum tubes onto the fittings of the valve assembly as noted from the removal.
2. Carefully place the assembly into the instrument and reinstall the hardware.
3. Connect all wiring cables disconnected during the removal.
4. Close the top access doors that were opened earlier.
5. Ensure the instrument is ready to be turned ON and verify the system operation.
6. After turning the ***VITEK•2®*** instrument ON and insuring the instrument status is OK, open a diagnostic terminal.
7. From the diagnostic prompt type **N_VAC** and press **ENTER**. (The prompt should reappear.)
8. From the prompt type **$sv.149=90** and press **ENTER**. (The prompt should reappear.)
9. Position a boat underneath the vacuum chamber, squarely up against the transport rails.
10. From the prompt type **VAC_CYCLE** and press **ENTER**. A vacuum cycle should occur.
11. Perform another vac_cycle.
12. From the diagnostic terminal determine if any errors occurred. If they did, from the prompt type **$sv.149=120**, press **ENTER** and perform two more vac_cycles. Confirm no failures occurred.
13. Perform Alignments (See Appendix E - Alignment Procedure.)

Vacuum Pump Replacement

Refer to Figure 5-48 for the location of the vacuum pump.

Removal

1. Open the top covers and remove the rear access cover to expose the vacuum pump.
2. Remove the left end panel of the instrument to gain access to the vacuum chamber and vacuum pump.
3. Disconnect the vacuum tubing from the vacuum pump.
4. Tag and disconnect all four wires from the vacuum pump solid state relay.
5. Disconnect housing connector which attaches the pump to the power supply.
6. Remove the four mounting screws securing the vacuum pump plate to the base pan.
7. Gently lift and remove the vacuum pump assembly from the instrument through the rear opening and set on a flat table top surface. Remove the intake filter from the pump and set aside.
8. Note the order of the hardware and then remove the four mounting screws, corresponding hardware and vibration isolation bushings that secure the feet of the pump to the vacuum pump plate.
9. Set aside the vacuum pump to be returned for exchange or repair (if required).

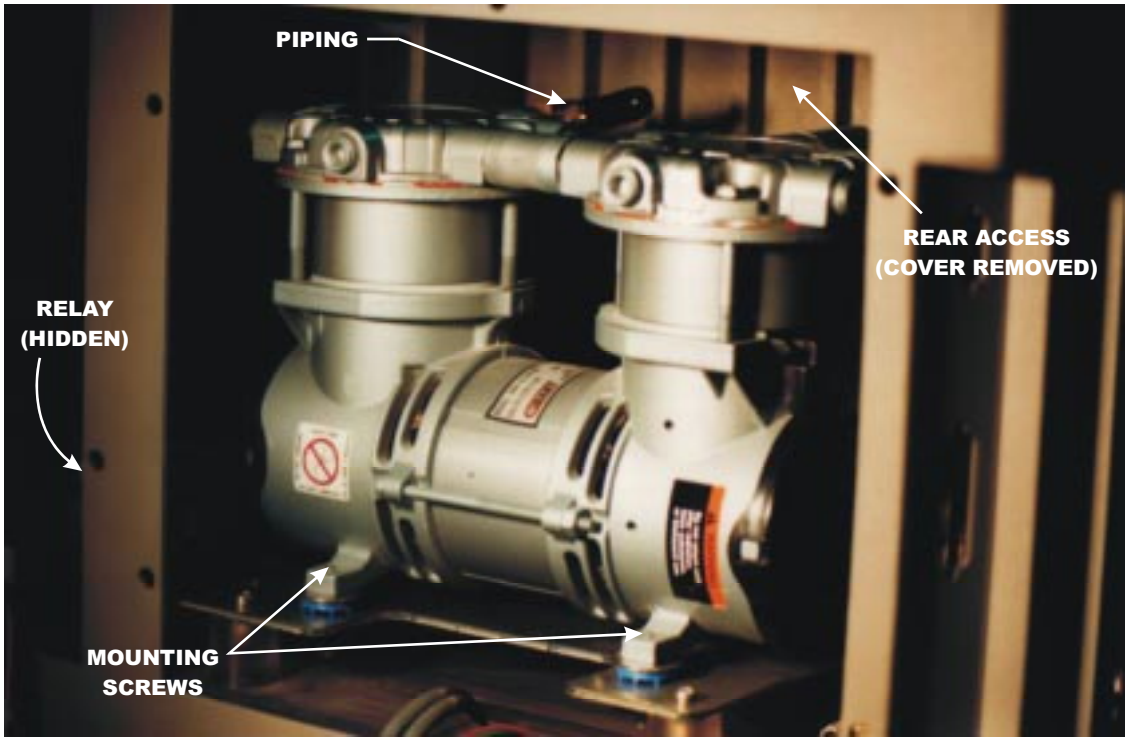


Figure 5-48 Vacuum Pump Replacement

Installation

1. Install the intake muffler into the intake opening of the vacuum pump. *Use teflon pipe sealent only!*
2. Using the appropriate hardware and vibration isolation bushings, mount the vacuum pump to the vacuum pump plate as previously noted.
3. Carefully place the vacuum pump into the instrument through the rear opening.
4. Install the four mounting screws on each of the mounting feet to secure the vacuum pump in the instrument.
5. Connect all wiring and tubing disconnected from the removal.
6. Install the left side access cover on the instrument.
7. Install the rear access cover on the instrument
8. Close the top access doors that were opened earlier.
9. Ensure the instrument is ready to be turned ON and verify the system operation.
10. After turning the ***VITEK•2®*** instrument ON, perform Alignments (See Appendix E - Alignment Procedure.)

Instrument Cabinet Fans Replacement

Refer to Figure 5-49 for the location of the instrument cabinet fans.

Removal

1. Open the top left and right covers of the instrument.
2. Tag and disconnect the wiring connector for the cabinet fan(s) where attached to the various circuit boards.
3. Remove the mounting nuts from finger guards covering the cabinet fan(s).
4. Note the fan position and air flow arrow then remove the mounting bolts from the fan(s) and remove the fan(s) from the instrument.
5. Discard the fan(s).

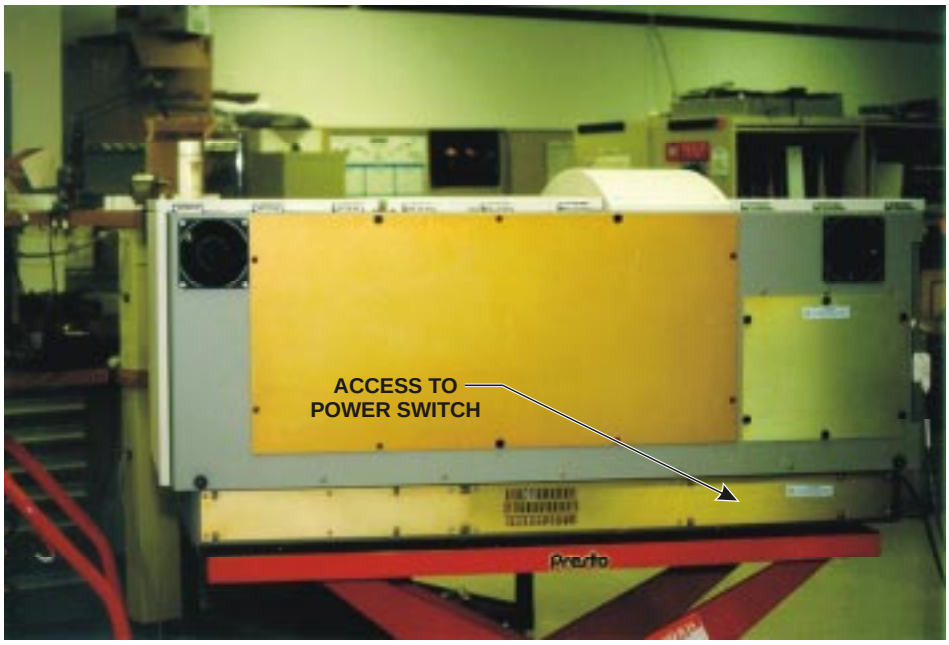


Figure 5-49 Instrument Cabinet Fans Replacement

Installation

1. Carefully place the cabinet fan(s) into the instrument with the proper noted position and air flow arrow from the removal. (When facing the front of the ***VITEK•2®***, the left fan should be blowing into the instrument and the right fan should be blowing out of the instrument.)
2. Install the mounting bolts for the fan(s).
3. Connect all wiring cables disconnected from the removal.
4. Install the finger guards on the fan(s) and tighten the mounting nuts.
5. Close the top access doors that were opened earlier.
6. Ensure the instrument is ready to be turned ON and verify the system operation.

Laser Bar Code Scanner Replacement

Refer to Figure 5-50 for the Laser Bar Code Scanner location.

Removal

1. Open the front covers of the instrument.
2. Scribe a line around the scanner mounting bracket then remove the mounting screws from the scanner mounting bracket.
3. Tag and disconnect the flat cable from the laser bar code scanner.
4. Note the position of the scanner on the bracket and then remove the cover and scanner.
5. Set the scanner aside for return repair or replacement.

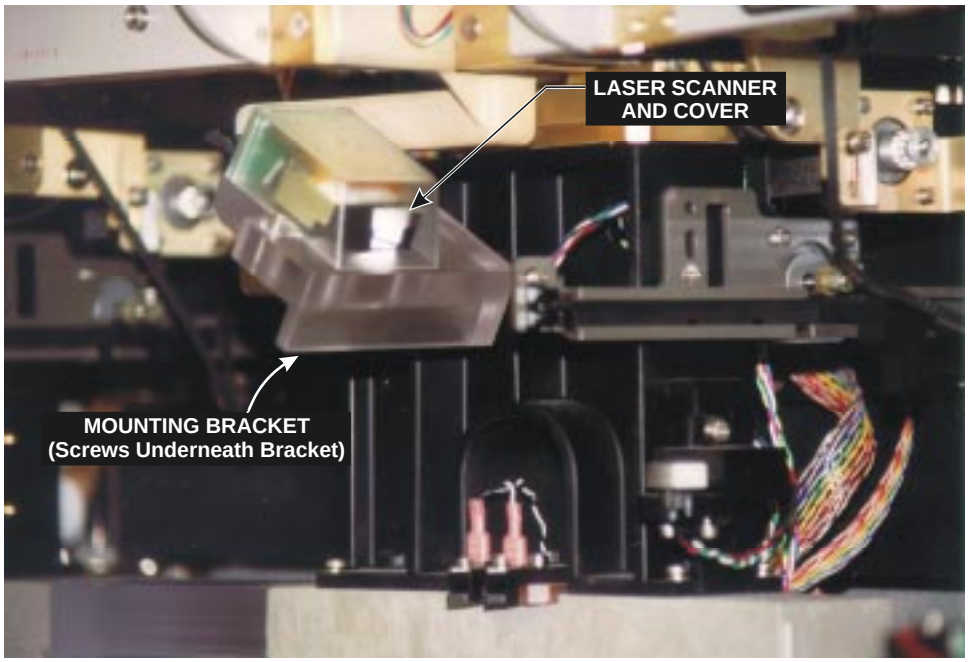


Figure 5-50 Laser Bar Code Scanner Replacement

Installation

1. Install the scanner and cover onto the mounting bracket as noted from the removal. Tighten the mounting screws.
2. Reconnect the scanner flat cable.
3. Install the mounting bracket to the scribe mark made during the removal.
4. Snug the mounting screws for the scanner mounting bracket.
5. Ensure the instrument is ready to be turned ON and verify the system operation.
6. After turning the ***VITEK•2®*** instrument ON, perform Alignments (See Appendix E - Alignment Procedure.)

WARNING! Laser Bar Code Scanner is a laser light. Do not stare into the beam.

Cassette Button Contacts Replacement

Refer to Figure 5-51a and 5-51b for the cassette button contacts location.

Removal

1. Open the front covers of the instrument.
2. Tag the wiring for the cassette button contacts.
3. Disconnect the wiring from the spade terminals.
4. Remove mounting screw(s) holding the contacts.
5. Set the cassette button contacts aside for repair or exchange.

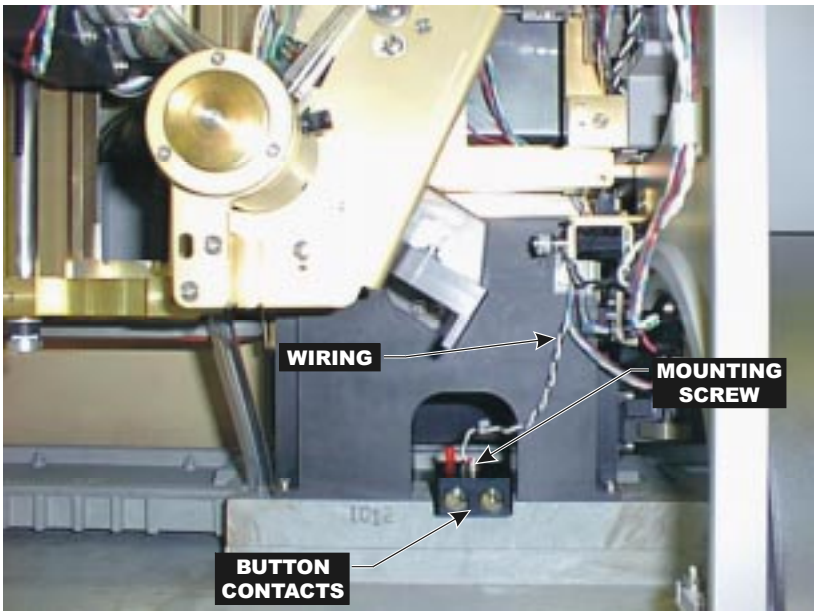


Figure 5-51a Cassette Button Contacts Replacement (old design)

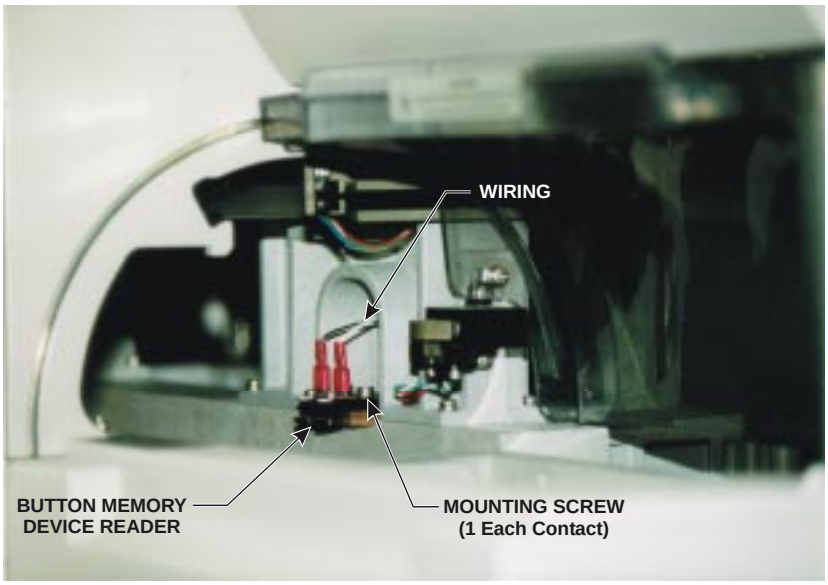


Figure 5-51b Cassette Button Contacts Replacement (new design)

Installation

1. Mount cassette button contacts and tighten mounting screw(s).
2. Reconnect wiring to cassette button spade terminals.
3. Turn the ***VITEK•2®*** instrument ON.
4. If the cassette button contacts are the new design, verify operation. If the cassette button contacts are the old design, perform Alignments (See Appendix E - Alignment Procedure.)

Sealer Hot Wire Assembly Replacement

WARNING! The Sealer Station contains a wire that is heated during the sealing operation. The proper precautions should be taken.

Refer to Figures 5-52 and 5-53 for the Sealer Hot Wire Replacement.

Removals

1. Open the top covers of the instrument. Disconnect the drain tube from the Diluter Cover and then unscrew and move the Diluter Cover (including the saline bag) to the side.
2. Note the position of the Sealer Hot Wire mounting and remove the mounting screws.
3. Disconnect the wiring from the Sealer Hot Wire Assembly and remove the assembly from the instrument.

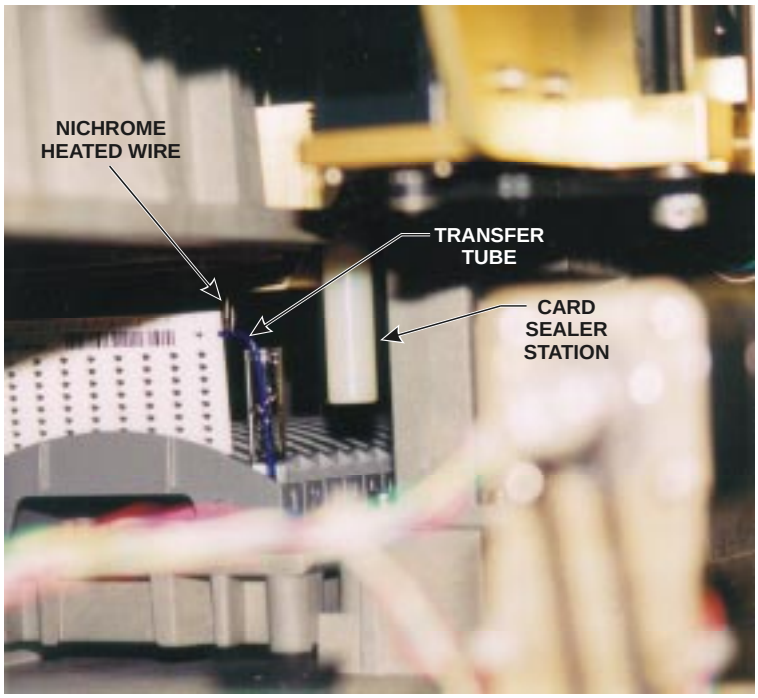


Figure 5-52 Sealer Hot Wire Assembly

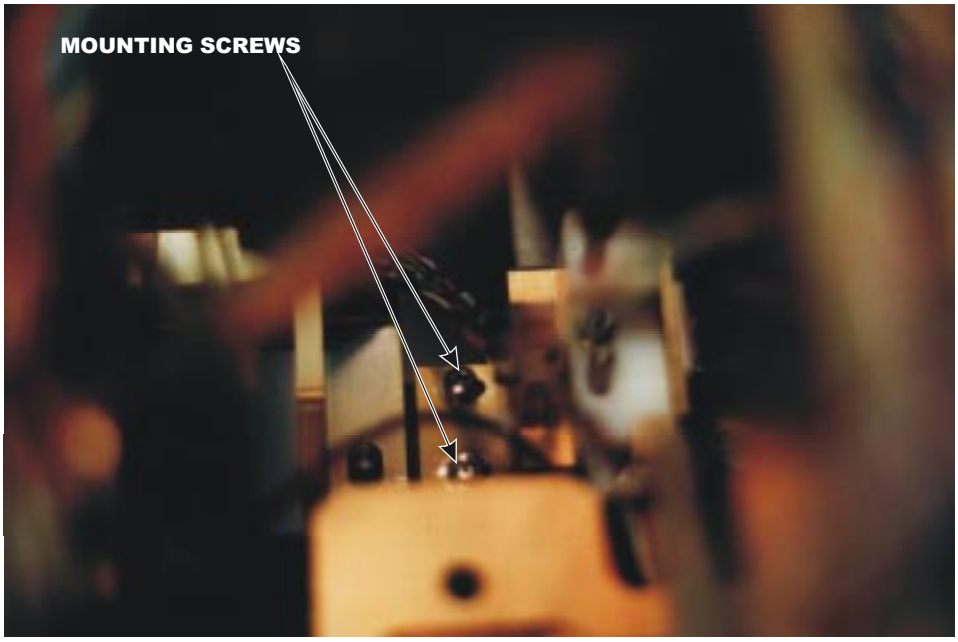


Figure 5-53 Sealer Hot Wire Mounting Screws

Installation

1. Place the Sealer Hot Wire Assembly into the instrument.
2. Install the mounting screws to the Sealer Hot Wire Assembly. Align to the noted position from removal and tighten the mounting screws.
3. Connect the wiring as noted from the removal.
4. Ensure the instrument is ready to be turned "ON" and check the instrument operation.
5. Perform the alignment procedure for the Sealer Hot Wire Assembly (See Appendix E - Alignment Procedure).
6. Re-install the Diluter Cover (including the saline bag) and then re-connect the drain tube.

Chapter Six: **Troubleshooting**

This chapter contains information to aid in diagnosing problems with the ***VITEK•2***® instrument. Refer to the ***VITEK•2***® Operators Manual for additional information.

WARNING!— POTENTIAL BIOHAZARDOUS MATERIAL

Instrument surfaces and contamination test kit components are potentially biohazardous and should be handled according to good laboratory practices. Observe universal precautions when operating the instrument and when performing maintenance or troubleshooting.

Instrument Diagnostics Using Development Macro Language (DML)

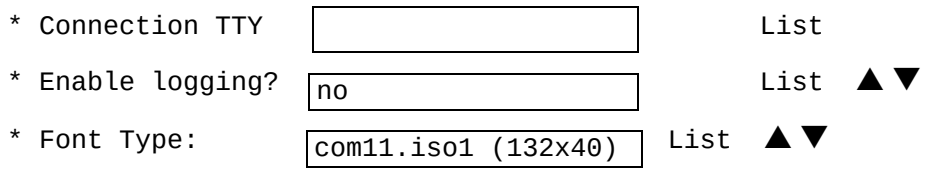
Accessing the DML

The Development Macro Language (DML) is a tool used for determining, diagnosing and maintaining the ***VITEK•2***® instrument. The DML can be accessed using three different methods. It can be opened through the diagnostic window of the Work Station, by a physical connection from the instrument to a PC, or by remote communication.

WARNING! It is imperative that the operator accessing the Development Macro Language (DML) type all commands with preexisting knowledge of the result. **Erroneously executing commands or changing variables could have a detrimental effect on the operation of the *VITEK•2*® instrument.** Any person accessing the DML should first have the proper training through bioMérieux, Inc.

Accessing DML Using Diagnostic Terminal of the Work Station.

1. At the bioMérieux - bioLIAISON Main Menu select **System, System Maintenance** and **Diagnostic Terminal.**
2. The following menu will appear:



3. Press the **List** button located across from Connection TTY. All the TTY ports configured for diagnostics communication will be displayed in a pop-up window.
4. Select the associated tty port the ***VITEK•2***® instrument diagnostic cable is plugged into on the Work Station. (Refer to Table 2-2 for Proper TTY Connections)

5. If you wish to enable logging, press the arrow button to change the no to a yes.

   Enable Logging?
   If **Yes** is chosen, the Work Station will keep a captured log of the diagnostics terminal session. When the diagnostics terminal is closed, a file will be created on the Work Station hard drive. This file can be copied to a DOS floppy disk and read by a PC using the following procedure.

   a) At the dms> prompt type **`cd /tmp`** and press **ENTER**. This will change the present working directory of the Work Station to /tmp.
   b) At the dms> prompt type **`ll`** and press **ENTER**. A list similar to the following will appear:

```
-rw-r—r---  1 root  system  10346 15 Dec 10:00 AixtermLog.23YEa
drwxrwxrwx  2 root  system    512 15 Dec  9:57 vartmp/
drwxrwxrwx  2 root  system    512 15 Dec 02:00 qdaemon/
```

   c) The filename containing **AixtermLog** is the captured log file. Insert a floppy into the floppy drive of the Work Station. From the dms> prompt type **`doswrite AixtermLog.XXXX log.txt`** and press **ENTER**. (XXXX = the corresponding extension.)
   d) The file will be called 'log.txt' on the floppy and can be read using a PC and Notepad, Wordpad, or Word.

NOTE: To print this file directly from the Work Station, it is only necessary to type **`lp AixtermLog.XXXX`** and press **ENTER**.

6. Once all the fields are properly selected, press the **EXECUTE** button.
7. A Diagnostics Terminal window will appear.
8. Press the ESCAPE key twice on the Work Station to display the instrument DML prompt. (The prompt will be displayed with the given instrument name.)

WARNING! Pressing the ENTER key will execute the last command the instrument was given.

- To disconnect from DML either close the Diagnostic Terminal or press the **CTRL** and **** keys simultaneously, immediately followed by the letter **c**. (WARNING: Always disconnect when complete!)

Accessing DML Using Physical Connection From *VITEK•2®* to PC

1. Connect the data/diagnostic reader cable to the ***VITEK•2®*** instrument. Connect the end of the cable marked DIAGNOSTIC to an available PC COM port.
2. Open Hyper Terminal or an equivalent communications software package on the PC. Configure the communication package COM port as follows:
   - Terminal - VT100
   - Baud Rate - 9600
   - Parity - None
   - Data Bits - 8
   - Stop Bits - 1
   - Flow Control - none

3. From the communication window press the **SPACE** and **BACKSPACE** key each once. The instrument prompt should appear. (The prompt will be displayed with the given instrument name.) **Warning: Pressing the ENTER key will execute the last command the instrument was given.**

Accessing DML using remote communication

Remote communication to the instrument can occur two different ways. Communication can be established via modem or network. This section will only define remote communication via modem.

1. Ensure ***VITEK•2®*** system modem was previously configured, connected and turned on. (See Chapter Six - Remote Diagnostics Setup.)
2. Open Hyper Terminal or an equivalent communications software package on the PC.
3. Configure the communication package COM port as follows:
   - Terminal - VT100
   - Baud Rate - XXXX (Setting should be appropriate for PC modem.)
   - Parity - None
   - Data Bits - 8
   - Stop Bits - 1

4. Dial the ***VITEK•2®*** system modem phone number and wait for a connection. A **`login`** prompt will appear if connected successfully.
5. At the **`login`** prompt type **`dms`** and press **ENTER**.
6. A **`password`** prompt will appear. Type **`dms`** and press **ENTER**.
7. A **`dms>`** prompt will appear. At the **`dms`** prompt connect to the corresponding ***VITEK•2®*** diagnostic port. This would be accomplished by typing either **`dml1, dml2, dml3`** or **`dml4`** and press **ENTER**. Refer to Table 6-1.

Table 6-1 Remote Diagnostic Connection

INSTRUMENT	PHYSICAL DIAGNOSTIC CONNECTION	COMMAND TO TYPE
1	tty3	**dml1**
2	tty5	**dml2**
3	tty7	**dml3**
4	tty11	**dml4**

8. Press the **SPACE** and the **BACKSPACE** key each once to display the instrument diagnostic prompt. **Warning: Pressing the ENTER key will execute the last command the instrument was given.**

   - To disconnect from DML press the **CTRL** and **** keys simultaneously, immediately followed by the letter **c**.
   - To disconnect from the Work Station, at the dms prompt type **exit** and press **ENTER**.

Searching for DML Commands and Variables

There are over five hundred commands and variables in the ***VITEK•2®*** DML. To simplify searching for a specific command there have been tools put into place. They are MANUAL, WORDS, CMDS and VARS. There is no case sensitivity to DML commands or variables, so they can be typed in either upper or lower case. Entering a question mark (**?**) after a command or variable will display a help text of that command.

- MANUAL is the entire list of commands and variables in DML along with its associated help text. Because the text output is extremely long and scrolls off the screen, it is recommended that a capture file be enabled prior to executing the MANUAL command. Once a capture file is enabled, type **MANUAL** and press **ENTER**. It will take several minutes for the MANUAL command to complete and a instrument prompt to reappear. Stop the capture file and review as necessary.

- By typing **WORDS** and pressing **ENTER**, the entire list of commands and variables in DML will be displayed in group form. Prior to scrolling off the screen 'Press any key to continue…' will be displayed. To escape from the scroll, press the **q** key.

To search for a specific command or variable, type **WORDS [pattern]** and press **ENTER**. The **[pattern]** is the text of the command being searched. For example, typing WORDS VAC and pressing ENTER will display all DML commands and variables containing VAC. (See Figure 6-1 Words Example One.)

```
VTK2 A > words vac

SPN:
VAC_CYCLE        VAC_UP              VAC_DOWN
VAC_INIT         VAC_STAT            VAC_DUMP
CAL_VAC          ALIGN_VAC_DOWN      N_VAC

System:

$VACUUM_EN

VTK2 A >
```

Figure 6-1 Words Example One

Words are categorized into 16 groups (shown below). To search for commands and variables in a specific group, type WORDS followed by a space, a comma (,) and the group. For example typing WORDS ,TRANS and pressing ENTER will list all commands in the Transmittance group. (See Figure 6-2 Words Example Two.) Note: The entire group name does not have to be entered.

DML Groups:

Keywords	Boat	DATA
diagnostics	Flash	Fluorescence
HCB	Host Communication	Motor
Network	Sequence	Sound
SPN	System	Touch
Transmittance		

```
VTK2 A > words ,trans

Transmittance:
READWAVE                TX_BURN                 TX_DATA_BURN
OPT_INT_BURN            CALWAVE                 VALWAVE
TX_STATUS               $TX_CAL_VAL             $TX2_MASK
$TX3_MASK               $LED_DELAY              $LED_BIAS_A1
$LED_BIAS_A2            $LED_BIAS_A3            $LED_BIAS_B1
$LED_BIAS_B2            $LED_BIAS_B3            $TX1_MIN_DAC
$TX1_MAX_DAC            $TX2_MIN_DAC            $TX2_MAX_DAC
$TX_ERROR               $TX_READS               $TX_HI
$TX_LO                  $TX_COOL_TIME           $TX_CAL_COOL_TIME
$TX_AIR_                TX_STEPS_INTO_WELL
                        $READS_ACROSS_WELL
$PR_SCAN

VTK2 A >
```

Figure 6-2 Words Example Two

To search for commands and variables beginning with a specific text pattern, type WORDS followed by a space, a carrot (^) and a [pattern]. For example, typing WORDS ^SEQ and press ENTER will list all the commands and variables beginning with SEQ. (See Figure 6-3 Words Example Three.)

```
VTK2 A > words ^seq


Sequence:
SEQ_RESUME          SEQ_PAUSE       SEQ_STATUS
SEQ_STATUS_RESET    $SEQ_STATE


VTK2 A >
```

Figure 6-3 Words Example Three

- **CMDS** and **VARS** are used the same way as WORDS. If CMDS is typed, the entire list of commands are scrolled on the screen. If VARS is typed, the entire list of variables are scrolled on the screen. To find a specific command, type CMDS [pattern] and press ENTER. To find a specific variable, type VARS [pattern] and press ENTER.

- Entering a question mark (**?**) after a command or variable will display a short definition or help text of that command. For example, by typing TX_STATUS ? and pressing ENTER a short description of the command TX_STATUS will be displayed. (See Figure 6-4 Words Example Four.)

```
VTK2 A > tx_status ?
TX_STATUS Displays the Transmittance Status
```

Figure 6-4 Words Example Four

TRANSPORTS

There are four transports in the *VITEK•2*® instrument that circulate 1-4 boats clockwise around the basepan. There are several commands and variables used in DML to verify status and interact with the boat transport system. They are BOAT_STATUS, BOAT_PAUSE, BOAT_RESUME, BOAT_ADVANCE, BOAT_PLAN, BOAT_STATUS_RESET, $BOAT_COUNT, $BOAT_SIM_LOAD and TRANS.

BOAT_STATUS

BOAT_STATUS indicates the position of each boat installed in the instrument, the total number of cycles each boat has made around the instrument, the total number of recovered jams on each boat, the total number of unrecovered jams on each boat, the status of each boat, and if a paddle is currently engaged with a boat. See Figure 6-5 BOAT_STATUS.

```
VTK2 A > BOAT_STATUS
Current Spot: SPOT_6:0 Total Cycles: 40, Retries: 0, Failures: 0
      Status: Empty
      Paddle:

Current Spot: SPOT_5:0 Total Cycles: 42, Retries: 0, Failures: 0
      Status: Empty
      Paddle:

Current Spot: SPOT_4:0 Total Cycles: 43, Retries: 0, Failures: 0
      Status: Empty
      Paddle:

Current Spot: SPOT_1:0 Total Cycles: 41, Retries: 6, Failures: 0
      Status: Empty
      Paddle: 1 4
```

Figure 6-5 BOAT_STATUS

Current Spot: SPOT_1:0 Total Cycles: 41, Retries: 6, Failures: 0

The SPOT is the current boat position. There are 6 boat positions on the ***VITEK•2®*** and 8 boat positions on the ***VITEK•2® XL***. (See Figure 6-6a ***VITEK•2®*** Boat Spots (positions) and Figure 6-6b ***VITEK•2®*** XL Boat Spots (positions).) In this case the boat is in spot 1. The 0 following the colon indicates the sub-spot. There are many sub-spots on the front and back transport for card preparation. (i.e. bar code positions, diluter position, pipettor position, auto-loading position, etc.)

When the transport system is not processing cards, it is in an idle state. When the ***VITEK•2®*** is in an idle state the proper boat positions are spots 1, 4, 5 & 6. When the ***VITEK•2® XL*** is in an idle state the proper boat spots are 1, 5, 5b & 6.

Total cycles indicates how many times the boat has circled the transport.

A retry is a jam that has been recovered by the instrument without user intervention.

A failure is a jam that has not been recovered by the instrument without user intervention.

Status: Empty
Indicates that the boat does not contain a cassette.
There are 7 statuses:

- **Empty** - indicates that the boat does not contain a cassette.
- **Loaded** - indicates that the boat is processing a cassette.
- **Completed** - indicates that the boat has completed processing its cassette and is waiting to have the cassette removed at the load/unload station.
- **Removing** - indicates that the boat is being removed from the instrument for cleaning.
- **Inactive** - indicates that the boat is not installed in the instrument.
- **Paused** - indicates that the boat has been halted by the instrument firmware due to a jam with a different boat. (This condition will also display if a manual boat_pause command is given.)
- **Jammed** - indicates that boat movement has failed and halted. User intervention is necessary.

Paddle: 1 4
Indicates that paddle 1 (front) and paddle 4 (right) are engaged on the boat in SPOT 1:0. See Figure 6-6a ***VITEK•2***® Boat Spots (positions) and Figure 6-6b ***VITEK•2***® XL Boat Spots (positions).

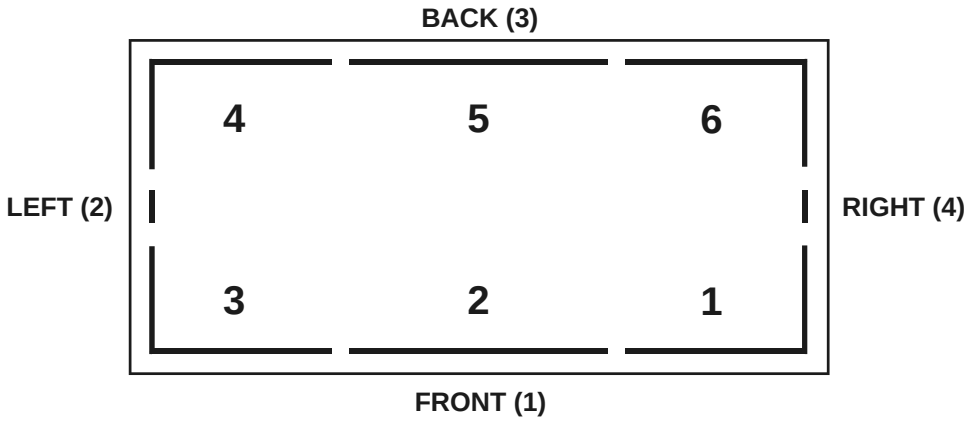


Figure 6-6a ***VITEK•2***® Boat Spots (positions)

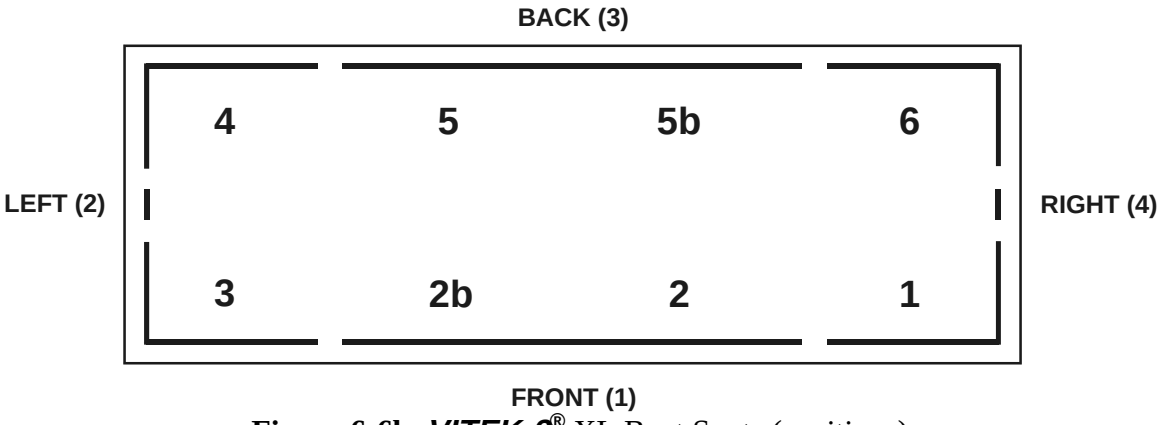


Figure 6-6b ***VITEK•2***® XL Boat Spots (positions)

BOAT_PAUSE

BOAT_PAUSE sends a pause command to each active boat. This is an interaction command and will stop the transports until a resume command is given.

BOAT_RESUME

BOAT_RESUME sends a resume command to each active boat.

BOAT_ADVANCE

BOAT_ADVANCE can be used to advance the boats to its next idle position. This can also be performed through the User Interface by selecting from the Main Menu: Utilities and Move Boat.

BOAT_PLAN

BOAT_PLAN can be used only after a cassette has been read and accepted by the bar code reader and touch memory. It must still be processing within the transports. Each boat has a number relative to how it was installed (i.e. 1-4). The BOAT_PLAN command must identify which boat to display the cassette processing information, therefore to check the BOAT_PLAN for boat 1, type **BOAT_PLAN 1** and press **ENTER**. (See Figure 6-7 BOAT_PLAN.)

```
VTK2 A > boat_plan 1
Current Spot: SPOT_4:0 Total Cycles: 1362, Retries: 355, Failures: 4
    Status: Loaded
    Paddle: 3

SCS ID: 'NS1'
Status: Real
Vacuum 0
Sealer 1
Slot |Source|Pip Source|Pip Vol|Dil|Card Info        |Cycles| Bar Code         |
Carousel
   1 |   67 |        0 |     0 | 0 |103 S N ST-GN06  |   73 | 031628200002069  |    A
   2 |   67 |        0 |     0 | 0 |103 S N AST-GN06 |   73 | 1031628200002030 |    A
   3 |   67 |        0 |     0 | 0 |103 S N AST-GN06 |   73 | 1031628200002036 |    A
   4 |   67 |        0 |     0 | 0 |103 S N AST-GN06 |   73 | 1031628200002047 |    A
   5 |   67 |        0 |     0 | 0 |103 S N AST-GN06 |   73 | 1031628200002012 |    A
   6 |   67 |        0 |     0 | 0 |103 S N AST-GN06 |   73 | 1031628200001997 |    A
   7 |   67 |        0 |     0 | 0 |103 S N AST-GN06 |   73 | 1031628200002082 |    A
   8 |   67 |        0 |     0 | 0 |103 S N AST-GN06 |   73 | 1031628200002059 |    A
   9 |   67 |        0 |     0 | 0 |103 S N AST-GN06 |   73 | 1031628200001968 |    A
  10 |   67 |        0 |     0 | 0 |103 S N AST-GN06 |   73 | 1031628200001977 |    A
  11 |   67 |        0 |     0 | 0 |103 S N AST-GN06 |   73 | 1031628200001343 |    A
  12 |   67 |        0 |     0 | 0 |103 S N AST-GN06 |   73 | 1031628200001327 |    A
  13 |   67 |        0 |     0 | 0 |103 S N AST-GN06 |   73 | 1031628200000825 |    A
  14 |   67 |        0 |     0 | 0 |103 S N AST-GN06 |   73 | 1031628200000856 |    A
  15 |   67 |        0 |     0 | 0 |103 S N AST-GN06 |   73 | 1031628200001220 |    A
```

Figure 6-7 BOAT_PLAN

BOAT_STATUS_RESET

BOAT_STATUS_RESET zeros the BOAT_STATUS parameters. If BOAT_STATUS_RESET is entered, it will display **WARNING: BOAT Status Non Volitale Values will be changed!** and ask **Do you wish to continue (Y/N).** If Y is entered, Total Cycles, Retries, and Failures will be set to 0. (See Figure 6-8 BOAT_STATUS_RESET) BOAT_STATUS_RESET also zeros the total number of boats processed in COMP_STATUS.

```
VTK2 A > BOAT_STATUS_RESET
WARNING: BOAT Status Non Volitale Values will be change!
         Do you wish to continue (Y/N): Y

VTK2 A > BOAT_STATUS
Current Spot: SPOT_6:0 Total Cycles: 0, Retries: 0, Failures: 0
    Status: Empty
    Paddle:

Current Spot: SPOT_5:0 Total Cycles: 0, Retries: 0, Failures: 0
    Status: Empty
    Paddle:

Current Spot: SPOT_4:0 Total Cycles: 0, Retries: 0, Failures: 0
    Status: Empty
    Paddle:

Current Spot: SPOT_1:0 Total Cycles: 0, Retries: 0, Failures: 0
    Status: Empty
  Paddle: 1 4
```

Figure 6-8 BOAT_STATUS_RESET

$BOAT_COUNT

$BOAT_COUNT is a variable and can be used to introduce boats into the instrument. Another way to do this is by performing a boat cleaning from the User Interface by selecting UTILITIES, MAINTENANCE, CLEANING and BOAT CLEANING. (NOTE: Reading the variable using a PR command is not a good representation of what is really installed. BOAT_STATUS should be used instead.)

The following are boat_count commands and the corresponding boat placement position. It is essential that the boats are placed in the proper corner, against both boat rails.

If **$BOAT_COUNT=1** is entered, it is necessary to place a boat in position 1.
If **$BOAT_COUNT=2** is entered, place the boats in positions 1 & 6
If **$BOAT_COUNT=3** is entered, place the boats in positions 1, 4, & 6.
If **$BOAT_COUNT=4** is entered, place the boats in spots 1, 3, 4, & 6.

When the boat_count command is entered, the instrument will respond with the following message:

Please COLD BOOT for changes to take effect
Place boats in outside corners

Position the boats as described above and then type **COLD** and press **ENTER**. The transport will then place the boats in the idle positions, awaiting new cassettes to be loaded.

Note that the above procedure can be used after a fatal boat jam.

$BOAT_SIM_LOAD

$BOAT_SIM_LOAD can be used for troubleshooting purposes when it is only necessary for cards to process around the transport and not load into the carousel. To enable this function type **$BOAT_SIM_LOAD=1** and press **ENTER**. Once finished with this tool, type **$BOAT_SIM_LOAD=0** and press **ENTER** to disable this function.

WARNING! It is imperative that $BOAT_SIM_LOAD=0 or COLD is performed prior to leaving instrument so cards will be loaded properly!

TRANS

The TRANS command is used in conjunction with keywords. These keywords tell the transport to achieve a specific task at a specific location. Following are the arguments and keywords with a description of how they are used.

♦ **Arguments:**	**Description**
<a>	**F, B, L** or **R** (Front, Back, Left & Right transports)
<c>	**1-15** (representing the card position on the cassette)
<n>	a number of steps
<p>	the pocket location on the corresponding transport (See Figure 6-9 ***VITEK•2®*** Transport Pocket Locations & Figure 6-10 ***VITEK•2® XL*** Transport Pocket Locations)

♦ **Keywords:**	**Description**
TRANS B <c>	With the front transport, position card <c> at the bar code reader.
TRANS C <a>	Performs a check home command to the front, back, left or right transport, displaying any lost steps.
TRANS D <c>	With the front transport, positions card <c> at the diluter.
TRANS H <a> <p>	Hooks the given transport boat pocket. (See Figure 6-9 VITEK•2® Transport Pocket Locations and Figure 6-10 VITEK•2® XL Transport Pocket Locations.)
TRANS I <a>	Initializes the front, back, left or right transport.
TRANS J <a> <n>	Jogs the given transport by <n> steps.

TRANS L <c>	With the back transport, places card <c> at the carousel load position.
TRANS M <a> <p>	Moves the boat to the given transport pocket position. (See Figure 6-9 VITEK•2® Transport Pocket Locations and Figure 6-10 VITEK•2® XL Transport Pocket Locations.)
TRANS P <c>	With the front transport, positions card <c> at the pipettor.
TRANS S	Executes the sealer (fast) move with the back transport.
TRANS T	Positions front transport at the button (touch) memory reader.
TRANS U <a>	Unhooks boat from front, back, left or right transport.

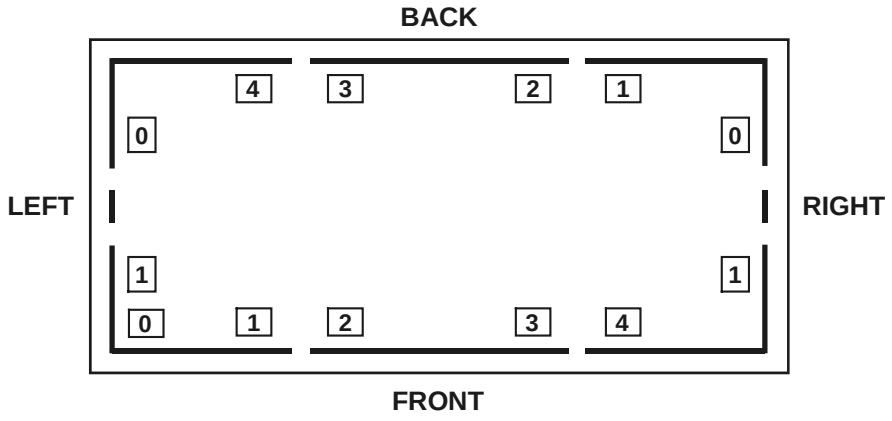


Figure 6-9 ***VITEK•2®*** Transport Pocket Locations

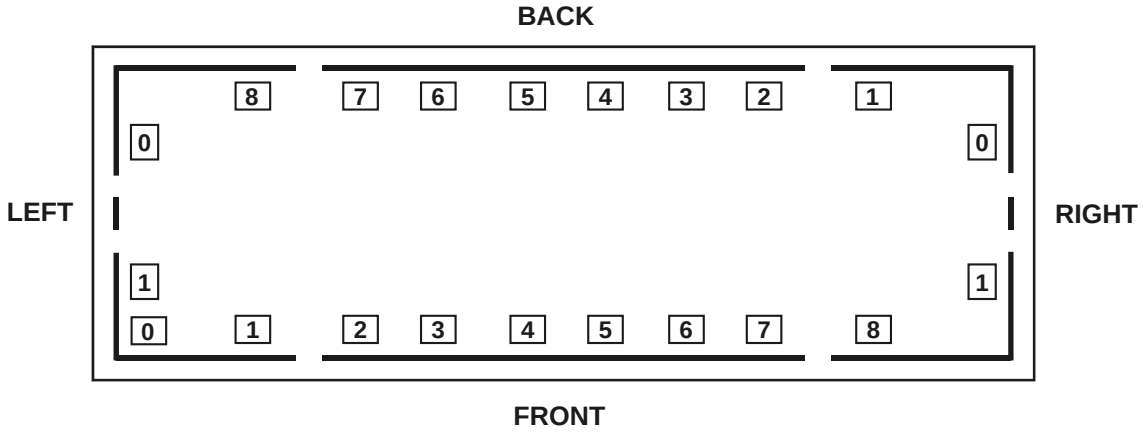


Figure 6-10 ***VITEK•2®*** XL Transport Pocket Locations

BARCODE

BAR

The BAR command can be used to activate and test the bar code reader. The three commands to use with this option are **BAR 0**, **BAR 1**, and **BAR 2**. (It is necessary to place a card's bar code in the path of the bar code reader beam to obtain the bar code information.)

- By placing a card with a bar code in position, typing **BAR 0** and pressing **ENTER**, the bar code number will be displayed. If the bar code reader fails to detect or read the bar code, it will display BAR CODE ERROR: **No Read**.

- BAR 1 is not used to test the bar code reader. (This is for development purposes only.)

- By placing a card with a bar code in position, typing **BAR 2** and pressing **ENTER**, the actual bar code, card type, IUO flag, card expiration date, and manufacturing information will be displayed. If the bar code reader fails to detect or read the bar code, it will display **BAR CODE ERROR**. (See Figure 6-11 BAR 2)

```
VTK2 A > BAR 2

Raw ASCII: '0100779000002592'
Card Type: 10
IOU Flag : 0
Exp Date : 887846399: Wed Feb 18 23:59:59 1998
Line ID  : 0
Dash LOT : 0
Sequence : 2592
Card LOT : 01007790
```

Figure 6-11 BAR 2

Button Memory Reader

TOUCH_RD_BOAT

TOUCH_RD_BOAT is performed by first placing a cassette with button memory in front of the button memory reader, so contact is made. Then type **TOUCH_RD_BOAT** and press **ENTER**. This will display information previously programmed from the SCS such as the station name (Boat ID), SCS version, Cassette Status (0=processed 1=not processed), cards set up in cassette, pipetting source, etc. See Figure 6-12 TOUCH_RD_BOAT.

NOTE: When a cassette is processed, the instrument does not delete the data from the button memory. Instead it changes the cassette status to processed (0). Only the SCS can delete the button memory.

```
VTK2 A >touch_rd_boat
 Boat ID : SCS Version : SCS Touch Version : BCB Touch Verison : Cassette Status
     CM5 :      R01.03 :                 A :                   :       0
Slot Status Array
  1  1  1  1  1  1  1  1  1  1  1  1  1  0

 #:Pip: Accession ID: Iso #:Card Type        :Organism Id:Ancillary Test:Modifier:Pro Track
 1: 0 :           1 :    1 :0101398300002413 :           :               :         :   0
 2: 1 :           1 :    1 :0761284300010927 :            :              :         :   0
 3: 0 :           2 :    1 :0101398300002415 :            :              :         :   0
 4: 3 :           2 :    1 :0761284300009728 :            :              :         :   0
 5: 0 :           3 :    1 : 0101398300002369:            :              :         :   0
 6: 5 :           3 :    1 : 0761284300010144:            :              :         :   0
 7: 0 :           4 :    1 : 0101398300002368:            :              :         :   0
 8: 7 :           4 :    1 : 0761284300009727:            :              :         :   37
 9: 0 :           5 :    1 : 0101398300000807:            :              :         :   23
10: 9 :           5 :    1 : 0761284300009726:            :              :         :   37
11: 0 :           6 :    1 : 0101398300002374:            :              :         :   23
12:11 :           6 :    1 : 0761284300009725:            :              :         :   18
13: 0 :           7 :    1 : 0101398300002373:            :              :         :   -1
14:13 :           7 :    1 : 0761284300009724:            :              :         :    0
15: 0 :             :    1 :                              :              :         :    0
```

Figure 6-12 TOUCH_RD_BOAT

TOUCH_SEARCH

The TOUCH_SEARCH command searches for all the touch devices in the instrument. To perform this command type **TOUCH_SEARCH** and press **ENTER.** The output text will include "Touch Serial Number". This is the BCB serial number and should always be detected unless there is a short in the circuitry. By positioning a cassette in front of the button memory reader and executing the same command, the cassette button memory should also be detected. When the cassette button memory is detected, the text will include "64Kbit Touch Memory". (See Figure 6-13 TOUCH_SEARCH.)

```
VTK2 A > touch_search
Family Code  : 0x0C, DS1996 64Kbit Touch Memory
Serial Number: 0x0000000439B9
CRC          : 0xED
Family Code  : 0x01, DS1990A Touch Serial Number
Serial Number: 0x000001EFDDCD
CRC          : 0x22
```

Figure 6-13 TOUCH_SEARCH

TOUCH_INIT

TOUCH_INIT initializes the button memory, getting it back to a known state. This is done by positioning a cassette in front of the button memory reader and executing the TOUCH_INIT command. The sentence "The touch is now initialized" will be displayed when complete.

DILUTER

DIL_DOWN

DIL_DOWN rotates the diluter dispensing tube to the down position. (If the cycle is completed without errors, no message will be displayed.)

Dil_down includes:

- Rotating the diluter motor to a pre-aligned number steps clockwise, so the dispensing tube is in the down position.

DIL_INIT

The command DIL_INIT initializes the Diluter. (If the cycle is completed without errors, no message will be displayed.)

Initializing the diluter includes:

- The diluter motor rotating the dispensing tube counterclockwise to its home position. (The home position is determined when the diluter home sensor detects the flag on the diluter block.)
- Returning the dispensing tube to its idle position.
- Running diluter pump motor all the way out until detected by diluter pump home sensor and then returning to its idle state.

DIL_FILL

DIL_FILL fills the dispensing tube with saline. (If the cycle is completed without errors, no message will be displayed.)

Dil_fill includes:

- The diluter motor rotating the dispensing tube counterclockwise to its home position. (The home position is determined when the diluter home sensor detects the flag on the diluter block.)
- Verifying the air read of the dispensing tube using the diluter sensor assembly.
- Engaging the diluter solenoid, allowing the saline to begin filling the dispensing tube.
- Detecting the saline at the tip of the tube using the diluter sensor assembly.
- Disengaging the solenoid, stopping the flow of saline.

DIL_EMPTY

DIL_EMPTY empties the diluter dispensing tube. (If the cycle is completed without errors, no message will be displayed.)

Dil_empty includes:

- The diluter motor rotating the dispensing tube a pre-aligned number steps clockwise, so the dispensing tube is in the down position.
- Activating the diluter pump so it forces air out of the dispensing tube at a controlled rate.
- Initializing the diluter.

DIL_CYCLE

Performs both the dil_fill and dil_empty commands. (If the cycle is completed without errors, no message will be displayed.)

Dil_cycle includes:

- The diluter motor rotating the dispensing tube counterclockwise to its home position. (The home position is determined when the diluter home sensor detects the flag on the diluter block.)
- Verifying the air read of the dispensing tube using the diluter sensor assembly.
- Engaging the diluter solenoid, allowing the saline to begin filling the dispensing tube.
- Detecting the saline at the tip of the tube using a optical sensor.
- Disengaging the solenoid, stopping the flow of saline.
- The diluter motor rotating the dispensing tube a pre-aligned number of steps clockwise, so the dispensing tube is in the down position.
- Activating the diluter pump so it forces air out of the tube at a controlled rate.
- `Initializing` the diluter.
- Returning dispensing tube to its idle position

$DILUTER_EN

$DILUTER_EN enables/disables the diluter component. This is a variable that is stored in non-volatile memory. To determine its value, it is necessary to enter PR before the command. If a 1 is displayed, the diluter is enabled. Typing **`$DILUTER_EN=0`** and pressing **`ENTER`** will disable the diluter, so it will not operate when cards are processing. **For proper instrument operation it is imperative that the diluter is enabled prior to exiting DML.** To accomplish this use the command $DILUTER_EN=1 or INST_DEFAULTS.

PIPETTOR

When a pipettor alarm occurs, review the flash log. (See flash_log later in this chapter.) Within the log and near the alarm message there should be a detailed line with a description of a prep failure, a get failure or a put failure.

A **PREP** failure will occur during the following steps:

- Initializing the pipettor. (See pip_init.)
- Rotating drum so a pipette tip falls into drum slot.
- Extending taper pin to insert into pipette tip.
- Verifying the presence of pipette tip by performing vacuum check using pressure transducer.
- Engaging solenoid to retract horizontal slide.
- The rotor motor rotating the pipettor snout a pre-aligned number of steps counterclockwise, so the pipette tip is in the down position.

A **GET** failure will occur during the following steps:

- The vertical motor lowering the pipette tip into a pre-existing volume of liquid in a test tube.
- The pipettor pump extracting the specified amount of liquid.
- The vertical motor raising the pipette tip from the test tube.
- Verifying presence of liquid in pipette tip by performing pressure check with pipettor pressure transducer.

A **PUT** failure will occur during the following steps:

- The vertical motor lowering the pipette tip into a test tube with pre-existing liquid.
- The pipettor pump evacuating the liquid from the pipette tip into the test tube and then extracting some of the mixed liquid.
- The vertical motor raising the pipette tip.
- The vertical motor lowering the pipette tip into the mixed liquid, completely evacuating the pipette tip and mixing liquid with forced air from the pump.
- The vertical motor raising the fully evacuated pipette tip.
- The pipettor pump homing.
- The vertical motor lowering and forcing air through pipette tip to complete mixing cycle.
- The taper pin retracting into the snout, therefore pushing the pipette tip off of the pin and dropping into the test tube of mixed liquid.
- Pipettor initializing.

PIP_INIT

PIP_INIT initializes the Pipettor. (If the cycle is completed without errors, no message will be displayed.)

Pip_init includes:

- Using the vertical motor to position the pipettor assembly in its vertical home position and then return to its idle position. (The pipettor vertical home position is determined when the pipettor vertical flag is detected by the pipettor vertical sensor.)
- Using the pipettor rotor motor to rotate the pipettor snout assembly to its home position and then returning to its idle position. (The pipettor rotor home position is determined when the pipettor rotor flag is detected by the pipettor rotor home sensor.)
- Retracting the pipettor taper pin motor assembly its home position and then returning to its idle position. (The pipettor taper home position is determined when the taper pin flag is detected by the taper pin home sensor.)
- Running pipettor pump motor all the way out until detected by pipettor pump home sensor and then returning to its idle position.
- Checking the ambient pressure using the pipettor pressure transducer.

PIP_GET

PIP_GET performs a pipette of a specified volume. It is necessary to enter a value after the PIP_GET command. The value should be between 100 and 300. For example, PIP_GET 100 will perform a pipette of 100 µl of liquid. (If the cycle is completed without errors, no message will be displayed.)

Pip_get includes:

- Initializing the pipettor. (See pip_init.)
- Rotating drum so a pipette tip falls into drum slot.
- Extending taper pin to insert into pipette tip.
- Verifying the presence of pipette tip by performing vacuum check using pressure transducer.
- Engaging solenoid to retract horizontal slide.
- The rotor motor rotating the pipettor snout a pre-aligned number of steps counterclockwise, so the pipette tip is in the down position.
- The vertical motor lowering the pipette tip into a pre-existing volume of liquid in a test tube.
- The pipettor pump extracting the specified amount of liquid.
- The vertical motor raising the pipette tip from the test tube.
- Verifying presence of liquid in pipette tip by performing pressure check with pipettor pressure transducer.

PIP_PUT

PIP_PUT performs a dispense of already pipetted fluid. (If the cycle is completed without errors, no message will be displayed.)

Pip_put includes:

- The vertical motor lowering the pipette tip into a test tube with pre-existing liquid.
- The pipettor pump evacuating the liquid from the pipette tip into the test tube and then extracting some of the mixed liquid.
- The vertical motor raising the pipette tip.
- The vertical motor lowering the pipette tip into the mixed liquid, completely evacuating the pipette tip and mixing liquid with forced air from the pump.
- The vertical motor raising the fully evacuated pipette tip.
- The vacuum pump homing.
- The vertical motor lowering and forcing air through pipette tip to complete mixing cycle.
- The taper pin retracting into the snout, therefore pushing the pipette tip off of the pin and dropping into the test tube of mixed liquid.
- Pipettor initializing.

DRUM_CYCLE

DRUM_CYCLE rotates the pipettor drum. This command will cause a pipette tip to fall into the drum slot, resting on the horizontal slide. (If the cycle is completed without errors, no message will be displayed.)

$PIPETTER_EN

$PIPETTER_EN enables/disables the pipettor component. This is a variable that is stored in non-volatile memory. To determine its value, it is necessary to enter PR before the command. If a 1 is displayed, the pipettor is enabled. Typing **$PIPETTER_EN=0** and pressing **ENTER** will disable the pipettor, so it will not operate when cards are processing. **For proper instrument operation it is imperative that the pipettor is enabled prior to exiting DML.** To accomplish this use the command $PIPETTER_EN=1 or INST_DEFAULTS.

VACUUM

VAC_INIT

VAC_INIT initializes the Vacuum. (If the cycle is completed without errors, no message will be displayed.)

Vac_init includes:

- Checking ambient pressure using vacuum pressure transducer and verifying that it is within range.
- Using the vacuum motor to position the vacuum chamber in its home position and then returning to its idle position. (The vacuum home position is determined when the vacuum flag is detected by the vacuum home sensor.)

VAC_DOWN

VAC_DOWN lowers the vacuum chamber while using the vacuum encoder sensor to detect stalls. Note: The vacuum home sensor is not used. (If the cycle is completed without errors, no message will be displayed.)

VAC_UP

VAC_UP uses the vacuum chamber motor to raise the vacuum chamber while using the vacuum encoder sensor to detect stalls. Note the vacuum home sensor is used. (If the cycle is completed without errors, no message will be displayed.)

VAC_CYCLE

VAC_CYCLE will lower the vacuum chamber onto a pre-existing boat, perform a vacuum process, raise the vacuum chamber back home and then return to its idle position. (The vacuum home position is determined when the vacuum flag is detected by the vacuum home sensor.) A vacuum encoder sensor is used to detect any stalls while moving the vacuum chamber up or down. (If the cycle is completed without errors, no message will be displayed.) Refer to Chapter Four, Vacuum Station for the Vacuum Chamber Pneumatic process.

VAC_STAT

Displays the status of the vacuum system. This includes ambient PSI. See Figure 6-14.

```
VTK2 A > vac_stat
PSI=13.6   A/D Counts( Coarse=205 Fine=255 )   Prop setpoint=1
RPF=0
```

Figure 6-14 VAC_STAT

VAC_DUMP

VAC_DUMP displays information from the last vacuum cycle. See Figure 6-15. The numbers displayed are readings from the pressure transducer and are used in a calculation based on the setting given when performing CAL_VAC. Therefore, all the readings are relative with the exception of the down and up slope. The normal pump down rate is .40 to .60 psi/second and the normal return rate is .40 to .60 psi/second.

```
VTK2 A > vac_dump
Start psi: 13.7
Hold psi   Start: 0.7   End: 0.7
End psi: 13.4
Time:  Down: 27   Up: 25   Cycle: 58
Prop valve bingo   Point: 151   Time: 6
(origianl method) Down slope: 0.48
Down slope: 0.48
  Up slope: 0.51
```

Figure 6-15 VAC_DUMP

$VACUUM_EN

$VACUUM_EN enables/disables the vacuum component. This is a variable that is stored in non-volatile memory. To determine its value, it is necessary to enter PR before the command. If a 1 is displayed, the vacuum is enabled. Typing **$VACUUM_EN=0** and pressing **ENTER** will disable the vacuum, so it will not operate when cards are processing. **For proper instrument operation it is imperative that the vacuum is enabled prior to exiting DML.** To accomplish this use the command VACUUM_EN=1 or INST_DEFAULTS.

$AVE_INSIDE_TEMP

$AVE_INSIDE_TEMP displays a three minute running average of the instruments inside temperature in C°. Because this command begins with a '$', it is a variable and has a value assigned to it. To determine its value, it is necessary to enter PR before the command. If the average inside temperature is 33° C or higher, a message will occur and cards can not be processed until the problem has been resolved. This average temperature can also be accessed through the User Interface by selecting Utilities, Diagnostics, Temperature. NOTE: The inside temperature thermistor is mounted to the top of the vacuum assembly.

SEALER

SEAL_INIT

SEAL_INIT initializes the Sealer. Initializing the sealer includes using the hot wire motor assembly to position the sealer wire in its home position and then returning to its idle position. (The sealer home position is determined when the sealer home sensor detects the bottom of the sealer flag.) (If the cycle is completed without errors, no message will be displayed.)

SEAL_DOWN

SEAL_DOWN causes the hot wire motor to lower the sealer wire until the sealer home sensor detects the top of the sealer flag.

SEAL_UP

SEAL_UP causes the hot wire motor to raise the sealer wire until the sealer home sensor detects the bottom of the sealer flag.

SEAL_ON

SEAL_ON causes the hot wire motor to lowers the sealer wire until the sealer home sensor detects the top of the sealer flag and then current is applied to heat the sealer wire.

SEAL_OFF

SEAL_OFF stops the current to the sealer wire and then causes the hot wire motor to raise the sealer wire until the sealer home sensor detects the bottom of the sealer flag.

SEAL_STAT

SEAL_STAT displays the current and voltage of the sealer. If the sealer wire is heating, the current and voltage will fluctuate. (See Figure 6-16 SEAL_STAT)

```
VTK2 A > seal_on

VTK2 A > seal_stat
Current: 8.47   Voltage: 1.59

VTK2 A >
AGAIN: seal_stat
Current: 0.13   Voltage: 0.00

VTK2 A >
AGAIN: seal_stat
Current: 8.47   Voltage: 1.41

VTK2 A 1084> seal_off
```

Figure 6-16 SEAL_STAT

TEST_SEALER

TEST_SEALER turns the sealer element on momentarily and displays the current and voltage. Normal amperage should be 8.5 ± 0.1 amp. See Figure 6-17 TEST_SEALER.

```
VTK2 A > TEST_SEALER
Sealer   Current: 8.47   Voltage: 1.72
```

Figure 6-17 TEST_SEALER

$SEALER_EN

$SEALER_EN enables/disables the sealer component. This is a variable that is stored in non-volatile memory. To determine its value, it is necessary to enter PR before the command. If a 1 is displayed, the sealer is enabled. Typing **$SEALER_EN=0** and pressing **ENTER** will disable the sealer, so it will not operate when cards are processing. **For proper instrument operation it is imperative that the sealer is enabled prior to exiting DML.** To accomplish this use the command $SEALER_EN=1 or INST_DEFAULTS.

AUTOLOADER

AL_INIT

AL_INIT initializes the autoloader to its autoloader home sensor. (If the cycle is completed without errors, no message will be displayed.)

AL_CYCLE

AL_CYCLE performs an autoloader cycle.

TRANSMITTANCE

TX_STATUS

TX_STATUS displays the current condition of all the transmittance optics installed. See Figure 6-18 TX_STATUS.

```
VTK2 A > tx_status

Led reads per step: 3
Number of HI values pitched: 0
Number of LO values pitched: 0
Cool time between each read: 10
Cool time between each calibration bit: 100
First scan point(Steps into well): 2 steps
Scans across the well: 16 scans
Calibration error range: +- 25 counts
Total data points(readings) per well: 48

                                    |               Channel DAC Values              |
Wave | Status| Target Cal|LED Delay|    1 |    2 |    3 |    4 |    5 |    6 |      7 |    8 |
TXA1 |    OK |      3400 |      60 | 2135 | 2245 | 2089 | 2143 | 3019 | 2331 |   2207 | 2184 |
TXA2 |    OK |      3400 |      60 |    0 | 2465 | 1644 | 3043 | 2672 |    0 |   2731 | 1822 |
```

Figure 6-18 TX_STATUS

- **Status -** Indicates if the Transmittance Optics has a status of 'OK' (functioning) or 'BAD' (not functioning).
- **LED Delay** -Indicates time in milliseconds that the channel LEDs are activated while reading a card.
- **Channel DAC Values** - Indicates the LED intensity to calibrate to the '**Target Cal**' (3400). ('0000' indicates that the channel is not functioning properly.)
- **Led reads per step** - Indicates the number of times the LED is flashed per stop across the well.
- **Number of HI values pitched -** Indicates the number of high flashes ignored in the algorithm.
- **Number of LO values pitched** - Indicates the number of low flashes ignored in the algorithm.
- **Cool time between each read** - Indicates a delay between flashes measured in milliseconds.
- **Cool time between each calibration bit** - Indicates a delay between calibration measured in milliseconds.
- **First scan point (Steps into well)** - Indicates how many steps are made into the well before the first flash is taken.
- **Scans across the well** - Indicates the number of stops across the well.
- **Total data points (readings) per well** - Indicates the number of flashes per well. (16 stops across the well multiplied by 3 reads (flashes) per stop equals 48 flashes per well.)

READWAVE

The READWAVE command reads the transmittance optics. It is necessary to enter the optics number after the command. For example, READWAVE 1 will read the Transmittance Optic 1 or READWAVE 2 will read the Transmittance Optic 2.

$SCREEN_DUMP

$SCREEN_DUMP is a variable and is used to set the output of READWAVE or READROW to a specific format.

They are:
$SCREEN_DUMP=0: No Dump
$SCREEN_DUMP=1: RAW and Calculations
$SCREEN_DUMP=2: SORTED and Calculations
$SCREEN_DUMP=3: Calculations Only
$SCREEN_DUMP=4: Averages via 'Echo Port'
$SCREEN_DUMP=5: Averages via DML

CALWAVE

The CALWAVE command calibrates and verifies the transmittance optics. It is necessary to enter the optics number after this command. For example, CALWAVE 1 for Transmittance Optics 1 (TX1) or CALWAVE 2 for Transmittance Optics 2 (TX2).

WARNING! This command should only be used when cards are not processing or a SEQ_PAUSE is invoked.

- Typing **CALWAVE 1** and pressing **ENTER** will display the calibration values for the transmittance 660nM optics (TX1) and the pass/fail result. See Figure 6-19 CALWAVE 1.

NOTE: Channel 1 is located closest to the optical interrupt.

```
VTK2 A > CALWAVE 1
LOG: 17::00:14:29.760 CALT ADC 3399, 3400, 3400, 3400, 3400, 3400, 3399, 3399,
LOG: 17::00:14:29.760 CALT DAC 3199, 3169, 3085, 3176, 3456, 3290, 3523, 2687,
LOG: 17::00:14:29.760 CALT Transmittance Calibration PASSED, Wavelength: 1
Calibration PASSED
```

Figure 6-19 CALWAVE 1

- Typing **CALWAVE 2** and pressing **ENTER** will display the calibration values for the Transmittance 568nM Optics (TX2) and the pass / fail result. See Figure 6-20 CALWAVE 2.

NOTE: Channel 1 is located closest to the optical interrupt.

```
VTK2 A > CALWAVE 2
LOG: 17::00:14:36.544 CALT ADC 3401, 3401, 3399, 3398, 3399, 3401, 3401, 3399,
LOG: 17::00:14:36.544 CALT DAC 0746, 1264, 0855, 2078, 1893, 0885, 1615, 1609,
LOG: 17::00:14:36.672 CALT Transmittance Calibration PASSED, Wavelength: 2
Calibration PASSED
```

Figure 6-20 CALWAVE 2

TESTINT

TESTINT will cycle the optical interrupts for the Fluorescence, Transmittance 1, and Transmittance 2 optics between the ‘on’ and ‘off’ states. (Transmittance 3 not available at this time.) If the digits under the ‘0 1 2’ are not changing between 0 and 1, then the corresponding optical assembly will need to be cleaned or replaced. See Figure 6-21 TESTINT.

WARNING! This command should only be used when cards are not processing or a SEQ_PAUSE is invoked.

```
VTK2 A > testint
Scanning Duart Input Port...( 250ms )
              DUART A
Spare_____________________________
Spare_____________________________    |
TX A 3 _________________    |    |
TX A 2 _____________    |    |    |
TX A 1 ________    |    |    |    |
FLUOR A___    |    |    |    |    |
          |   |    |    |    |    |
          0   1    2    3    4    5
Level: ON 0   0    0    0    1    1
```

Figure 6-21 TESTINT

See the MACROS section for **TX_TEST**.

FLUORESCENCE

FL_STATUS

FL_STATUS displays a detailed status of the fluorescence optics. See Figure 6-22 FL_STATUS.

```
VTK2 A > FL_STATUS
Installed: Yes, Functional: Yes
Version Rev: 4
FSTEPS( Steps into well ): 12
Liquid calibrations: 1
Solid calibrations: 9
DAC offset calibrations: 1
Software offset calibrations: 1
Total Number of Lamp Flashes: 2744180
Flash sector erase cycles: 16

Calibrations Targets
      Ref Channel | Data Channel Low(DAC) | Data Channel Low(SOFT) |Data Channel High(SHUTTLE)|Data Channel High POT)
target:+-cal:+-val |          target:+-cal:+-val |      XXXXXX:XXXXX:+-val |              xxxxxx:+-cal:+-val | target:+-cal:xxxx
 3500:   60:  175 |              10:     2:     5 |                          10: |                        50:  100 |  3800:   50

Target Shuttle Calibration Values (shuttle finger print)
*** *** |   Channel 2 |   Channel 3 |   Channel 4 |   Channel 5 |   Channel 6 |   Channel 7 | ****/****
        |        target |        target |        target |        target |        target |        target |
                2839 |         3117 |         3104 |         3139 |         3040 |         2742 |
Liquid Calibration Setting
Ref Pot |   Channel 2 |   Channel 3 |   Channel 4 |   Channel 5 |   Channel 6 |   Channel 7 | Time/Date
      pot |  dac:pot:off |  dac:pot:off |  dac:pot:off |  dac:pot:off |  dac:pot:off |  dac:pot:off |
    141 |  139: 94:  7 |141:107: 18 | 139:117: 70 | 141:103: 40 | 140: 84: 25 | 140: 35: 49 | Tue Dec 22 07:24:53 1998

Current Settings
Ref Pot |   Channel 2 |   Channel 3 |   Channel 4 |   Channel 5 |   Channel 6 |   Channel 7 | Time/Date
      pot |  dac:pot:off |  dac:pot:off |  dac:pot:off |  dac:pot:off |  dac:pot:off |  dac:pot:off |
    145 |  139:129:  9 |141:146: 21 |140:148: 71 |141:145: 45 |141:120: 28 | 139: 74: 54 | Thu Jul 01 09:59:40 1999
```

Figure 6-22 FL_STATUS

- **Installed** - 'Yes' indicates that the Fluorescence optical interrupt was detected on power up. 'No' indicates that the Fluorescence optical interrupt was not detected on power up.
- **Functional** - 'Yes' indicates that no automated validation failures have been detected by the firmware of the instrument. 'No' indicates that there has been a validation failure detected by the firmware of the instrument.
- **Version Rev** - Indicates the version of the fluorescence peak detector board.
- **FSTEPS (Steps into well)** - Indicates the optimum position for reading the well. It is set during the Fluorescence calibration while using the black alignment card. Typical values range from 7 to 15.
- **Liquid calibrations** - Indicates the number of successful calibrations performed using calibration liquid.
- **Solid calibrations** - Indicates the number of automatic internal digi POT calibrations performed using the solid reference standard on the shuttle.
- **DAC offset calibrations** - Indicates the number of automatic internal DAC calibrations performed using the solid reference standard. The DAC offset is an electronic offset adjustment to compensate for electronics variations.

- **Software offset calibrations** - Indicates the number of automatic internal soft-offset calibrations performed. The software offset is an offset that is used to compensate for electronic noise and physical impurities on the optical system. It is subtracted by the firmware from the readings.
- **Total Number of Lamp Flashes** - Indicates that the lamp has flashed 2744180 times. When a lamp is changed, this value should be reset to 0 by entering $FL_TOTAL_FLASHES=0 at the diagnostics prompt.
- **Flash sector erase cycles** - Indicates that 16 erases have been performed on the Bay Controller board memory. Each time the fluorescence history is updated with a new Gain (solid), DAC, or Soft-offset calibration performed by the automatic internal validation, this number is incremented. It only tracks the number of erase cycles of the FLASH ROM sector, this number should not exceed 100,000.
- **Calibrations Targets** - Indicates the values used by the calibration routines. The calibration routines adjust the parameters below until the values above are reached.
- **Target Shuttle Calibration Values (shuttle finger print)** - Indicates the value that the shuttle (solid standard) reads when the system is calibrated. These values are used to calibrate the system between liquid calibrations.
- **Liquid Calibration Setting** - Indicates the settings of the last liquid calibration.
- **Current Settings** - Indicates current settings from the fluorescence calibration. When the instrument is powered on the calibration is validated. Then it validates calibration again after 2 hours and then every 24 thereafter until power is cycled. (If cards are processing, it will wait for them to complete before performing calibration validation.)
- **Ref Pot** - Indicates the gain setting on the reference channel. It has a value range from 1 to 512. It will typically increase over time as the lamp ages.
- **Channel 2-7** - Each channel has a **DAC** offset typically 135 - 145. The **POT (gain)** value range is from 1 to 255. The **software offset** limit is less than 150.

FL_HISTORY

FL_HISTORY displays the fluorescence calibration history since the last liquid calibration. See Figure 6-23 FL_History.

```
VTK2 A > fl_history

Liquid Calibration Setting
Ref Pot |   Channel 2 |   Channel 3 |   Channel 4 |   Channel 5 |   Channel 6 |   Channel 7 | Time/Date
      pot |  dac:pot:off |   dac:pot:off |   dac:pot:off |   dac:pot:off |   dac:pot:off |  dac:pot:off |
     141 |  139: 94:  7 | 141:107: 18 | 139:117: 70 | 141:103: 40 | 140: 84: 25 |  140: 35: 49 | Tue Dec 22 07:24:53 1998

Pot(Gain) Calibration History
Ref Pot |   Channel 2 |   Channel 3 |   Channel 4 |   Channel 5 |   Channel 6 |  Channel 7 | Time/Date
      pot |  dac:pot:off |   dac:pot:off |   dac:pot:off |   dac:pot:off |   dac:pot:off |  dac:pot:off |
     143 |139:132: 10 | 141:152: 23 | 139:156: 73 | 141:152: 46 | 140:124: 28 | 140: 80: 57 | Thu Jul 01 11:40:15 1999
     145 | 139:129:  9 | 141:146: 21 | 140:148: 71 | 141:145: 45 | 141:120: 28 | 139: 74: 54 | Wed May 19 07:03:07 1999
     143 | 140:113:  9 | 141:132: 20 | 140:134: 71 | 141:129: 45 | 141:106: 28 | 139: 58: 52 | Sat Apr 24 12:07:13 1999
     141 | 140:100:  9 | 141:116: 20 | 140:122: 72 | 141:112: 43 |  141: 92: 26 | 139: 45: 51 | Sun Mar 07 23:05:49 1999

DAC(Offset) Calibration History
Ref Pot |   Channel 2 |   Channel 3 |   Channel 4 |   Channel 5 |   Channel 6 |   Channel 7 | Time/Date
      pot |  dac:pot:off |   dac:pot:off |  dac:pot:off |   dac:pot:off |  dac:pot:off |   dac:pot:off |
        0 |     0:   0:   0 |     0:   0:   0 |     0:   0:  0 |     0:   0:   0 |     0:   0:  0 |     0:    0:  0 |

Software Offset Calibration History
Ref Pot |   Channel 2 |   Channel 3 |   Channel 4 |   Channel 5 |   Channel 6 |   Channel 7 | Time/Date
      pot |  dac:pot:off |   dac:pot:off |  dac:pot:off |   dac:pot:off |   dac:pot:off |  dac:pot:off |
     143 | 139:132:10 | 141:152: 23 | 139:156:73 |  141:152:46 | 140:124: 28 | 140: 80: 57 | Thu Jul 01 11:40:15 1999
```

Figure 6-23 FL_History

HSHUTTLE & ESHUTTLE

HSHUTTLE homes the optical shuttle and ESHUTTLE extends the optical shuttle.

WARNING! This command should only be used when cards are not processing or a SEQ_PAUSE is invoked.

$FL_TOTAL_FLASHES

$FL_TOTAL_FLASHES indicates the number of times the flash lamp has flashed. Because this command begins with a '$', it is a variable and has a value assigned to it. To determine its value, it is necessary to enter PR before the command. When a lamp is changed, this value should be reset to 0 by entering $FL_TOTAL_FLASHES=0 at the Diagnostics prompt. See Figure 6-24 $FL_TOTAL_FLASHES.

```
VTK2 A > PR $FL_TOTAL_FLASHES
127305

VTK2 A > $FL_TOTAL_FLASHES=0
```

Figure 6-24 $FL_TOTAL_FLASHES

TESTINT

TESTINT will cycle the optical interrupts for the Fluorescence, Transmittance 1, and Transmittance 2 optics between the ‘on’ and ‘off’ states. (Transmittance 3 not available at this time.) If the digits under the ‘0 1 2’ are not changing between 0 and 1, then the corresponding optical assembly will need to be cleaned or replaced. See Figure 6-25 TESTINT.

WARNING! This command should only be used when cards are not processing or a SEQ_PAUSE is invoked.

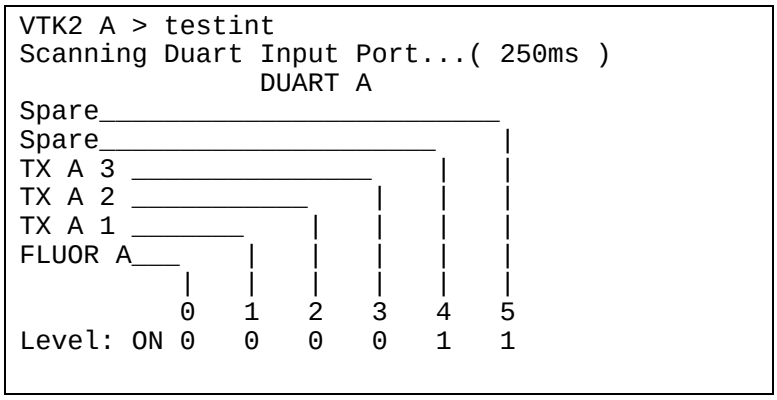


Figure 6-25 TESTINT

READROW

READROW will perform one set of fluorescence readings. See Figure 6-26 for READROW with a homed shuttle.

WARNING! This command should only be used when cards are not processing or a SEQ_PAUSE is invoked.

```
VTK2 A > readrow 1 1 1
RAW data
Reading  #      1     2     3     4     5     6     7      8
Reading  1   1510    34    40    36    46    37    51    250
Reading  2   3353    10    13     9    11    12    12    251
Reading  3   3257    12    15     9    16    11    19    252
Reading  4   3342    10    14     9    13     9    11    252
Reading  5   3334     8    13    12    13    11    11    252
Reading  6   3368    10    14     8    14    10    16    252
Reading  7   3277    10    13    11    19    12    16    253
Reading  8   3357    12    13     8    13    11    11    252
Reading  9   3417     9    13     7    10     9     9    253
Reading 10   3317     8     9    10    12    11    12    250

Configuration: 10 Samples, 2 Lo Pitched, 2 Hi Pitched
Channel #  AVG       SPREAD     HIGH        LOW       SD          CV

       1   3330        80       3357        3277     27.07      0.81 %
       2     10         3         12           9      0.90      8.83 %
       3     13         1         14          13      0.47      3.54 %
       4      9         3         11           8      0.94     10.10 %
       5     14         4         16          12      1.26      9.32 %
       6     11         2         12          10      0.58      5.25 %
       7     13         5         16          11      2.16     16.62 %
       8    252         1        252         251      0.37      0.15 %
```

Figure 6-26 READROW 1 1 1

$SCREEN_DUMP

$SCREEN_DUMP is a variable and is used to set the output of READWAVE or READROW to a specific format.

They are:
$SCREEN_DUMP=0: No Dump
$SCREEN_DUMP=1: RAW and Calculations
$SCREEN_DUMP=2: SORTED and Calculations
$SCREEN_DUMP=3: Calculations Only
$SCREEN_DUMP=4: Averages via 'Echo Port'
$SCREEN_DUMP=5: Averages via DML

VALFLUOR

VALFLUOR performs fluorescence optical validation and calibrates if out of range.

WARNING! This command should only be used when cards are not processing.

INCUBATOR

INCU_STAT

INCU_STAT displays the status of the incubator. See Figure 6-27 INCU_STAT.

NOTE: This is real time information about the incubator. The temperature accessed through the User Interface does not show this value, but instead is a three minute average.

```
VTK2 A > INCU_STAT
Card: 35.5 C  (215)   Actual: 35.8 C
Heater: 38 C  (94)
State: 2   Heater Drive= 24%   Std. Counts=220
Need: 0   Pend: 88     Maintain Bias=9   Pend
Offset=40
```

Figure 6-27 INCU_STAT

- **Card** - Indicates a calculated card temperature referencing the Actual reading. (There is no thermistor for this value.) The incubator maintains card temperature at 35.5 C° +/- 1.
- **Actual** - Indicates the real time temperature of the thermistor located inside the Incubator.
- **Heater** - Indicates the temperature reading from the thermistor located next to the Heater.
- **State** - Indicates the state of the incubator. 1 is warming. 2 is stable. Anything other than 1 or 2 signifies the heater is not functioning properly.
- **Heater Drive** - Indicates the percentage of output for the heater located inside the carousel incubator. If Heater Drive = 0%, then the heater is currently OFF. After the instrument is turned on, the heater will usually be at 100% output and will continue until the card temperature reaches close to 34.5 C°.

INIT_HEATER

INIT_HEATER initializes the incubator heater. It may be necessary to enter INIT_HEATER when the heater drive stays at 0%.

$AVE_INCU_TEMP

$AVE_INCU_TEMP indicates the three minute running average temperature of the incubator. Because this command begins with a '$', it is a variable and has a value assigned to it. To determine its value, it is necessary to enter PR before the command. The status on the User Interface will indicate 'Warming' until the average incubator temperature has risen to 34.5° C. Cards will not be processed until this average temperature has been accomplished, then the User Interface status will change to OK. This average temperature can also be accessed through the User Interface by selecting Utilities, Diagnostics, Temperature.

CAROUSEL

CARAMAP

CARAMAP indicates the number of cards in the carousel, the position of each card, the remaining number of readings to be processed on each card, the number of readings already taken on each card, the status of each card, card information, and the card bar code. See Figure 6-28 CARAMAP.

```
VTK2 A > caramap
   :Remaining: Current:
Pos:  Cycles :  Cycle :     Status :   Card Info           : Bar Code
  0:       66:      11:  Sequencing:   76 S N    AST-N009  : '0761319300003216'
  2:       50:      15:  Sequencing:   12 I      ID-YST    : '0121394300004917'
  4:        0:      77:   Completed:   59 S P    AST-P506  : '0591186300000353'
  8:        0:      77:   Completed:   59 S P    AST-P506  : '0591186300000354'
*24:        0:       0:       Empty:
 29:        0:      15:  Terminated:   76 S N    AST-N009  : '0761376300004153'
 43:       16:       1:  Sequencing:   10 I N   ID-GNB     : '0101313300002112'
 55:       77:       0:  Sequencing:   82 S P   AST-P515   : '0821304300002917'
 59:       30:       1:  Sequencing:   11 I P   ID-GPC     : '0111185300003908'
```

Figure 6-28 CARAMAP

- **Pos** - Indicates the slot position the cards are loaded into the carousel. The slot position with an * indicates the current read position (such as position '*24:' above). There are 60 available slots in each carousel, 0 through 59.
- **Remaining Cycles** - Indicates the number of reads remaining for the card in that position. If a determination is made on this card before the maximum number of reads is obtained, the remaining cycles will change to 0.
- **Current Cycle** - Indicates the number of reads already performed on the card in that position.
- **Status** - There are 4 status:
  - **Sequencing** indicates the card is still processing. This is the normal state.
  - **Completed** indicates that the card has finished reading and is waiting to be ejected from the carousel.

- ◊ **Empty** indicates that there is not a card in that position, however it is the current position aligned with the reader.
- ◊ **Terminated** indicates that an error has occurred while processing this card and it will no longer be read. It will remain in the carousel until it can be removed by other means. (See UNLOAD_CARD, ZEROSLOT or ***VITEK•2®*** Users Manual - Cleaning the Carousel.) 'Remaining Cycles': will indicate at which cycle processing was terminated.

- ♦ **Card Info** - Indicates the number for the card type in that position, the test type (I for ID, S for susceptibility), the gram stain (N for negative, P for positive, blank for others like Yeast) and the card name.
- ♦ **Bar Code** -Indicates the bar code number for the card in that position.

CARA

CARA will rotate the carousel to the reader position as indicated in the command, referencing the incubator top sensor. The carousel slot positions are numbered 0-59. This command can be used in conjunction with the UNLOAD_CARD command. Example: CARA 29

CARO_INIT

CARO_INIT initializes the carousel by referencing the incubator home sensor and aligning the carousel slot 0 with the reader. (If the cycle is completed without errors, no message will be displayed.)

WARNING! This command should only be used when cards are not processing or a **SEQ_PAUSE** is envoked.

CAROUSEL

The CAROUSEL command is strictly for the ***VITEK•2®-120*** instrument. The command typed is CAROUSEL A or CAROUSEL B. This sets the corresponding section (A or B) as the target, thus allowing commands executed to be directed to a specific section.

LOAD

The LOAD command is used to load cards into the carousel by means of the reader. When loading a card into the front of the reader, the card must be orientated properly. The interrupt holes of the card must be toward the bottom of the instrument and the remaining transfer tube nub must be facing the front of the instrument. The LOAD command also requires some additional information. It needs to know how many cards are being loaded, the number of cycles to perform on each card and the card type (See Well Map Definition). Example: LOAD 3 25 1

FLUSH_CAROUSEL

FLUSH_CAROUSEL will immediately eject any cards marked 'Completed' from the carousel.

UNLOAD_CARD

UNLOAD_CARD will change the status of the card in a specified location from a status of either 'Sequencing' or 'Terminated' to 'Completed'. With a status of 'Completed', the card will be ejected when that position is aligned with the reader. Example: UNLOAD_CARD 29

UNLOAD

UNLOAD will change the status of ALL the cards in the Carousel to 'Completed'. With a status of 'Completed', all the cards will be ejected when they are at the reader position.

ZEROSLOT

ZEROSLOT will change the status of the card in a specified location from a status of either 'Sequencing', 'Terminated', or 'Completed' to 'Empty'. (Example: ZEROSLOT 9) If a card still exists in the specified carousel position, it will be necessary to use the CARO command to gain access to the card and then remove it by hand. (Another option is Cleaning the Carousel - See ***VITEK•2®*** Users Manual.)

ZEROSLOTS

ZEROSLOTS will change the status of **ALL** the cards in the carousel from either 'Sequencing', 'Terminated', or 'Completed' to '**Empty**'. After typing the command it will first display 'WARNING: About to Zero the Carousel A Map' and ask 'Do you wish to continue (Y/N):'. If Y is entered, the status of all cards in the carousel will be changed to 'Empty'. If a card still exists in any position of the carousel, it will be necessary to use the CARO command to gain access to the card and then remove it by hand. (Another option is Cleaning the Carousel - See ***VITEK•2®*** Users Manual.)

SEQ_STATUS

SEQ_STATUS shows several status conditions of the carousel and several carousel counter mechanisms. Figure 6-29 shows an example of SEQ_STATUS.

```
VTK2 A > SEQ_STATUS

Carousel A Status
Total Cycles  : 74145
Total Retries : 392
Total Failures: 1

    Carousel Pos: 24
 Available Slots: 2
       Fast Read: 0
         Snaking: 0
 First Read Mode: 0
    Loading Mode: 1
  Flush Carousel: 0
  Lost Time Mode: 0
  Cycle Time(ms): 15000
    Card Retries: 0
Cards in Stacker: 0
 # Flr-Cal Cards: 0
 Current Flr-Cal: 0
Cara SPN Version: 161
   Cara SPN Dash: 2
Head SPN Version: 161
  Reserved Slots: 1
  Worst Elaspe T: 00::00:26:22.992
      Seq Status: OK
```

Figure 6-29 SEQ_STATUS

- **Total Cycles** - Indicates how many times the reader has read the cards loaded into the instrument.
- **Total Retries** - Indicates the number of times the carousel was not successful inserting a card into the reader, but recovered.
- **Total Failures** - Indicates the number of times the carousel was not successful inserting a card into the reader and could not recover. (A carousel halted jam.)
- **Available Slots** - Indicates the number of slots available for loading cards into the Carousel. (This is also displayed on the User Interface status screen.)
- **Cards in Stacker** - Indicates the number of cards in the stacker.
- **Seq Status** -Indicates the status of the carousel and reader. There are 10 status:
  - **OK** indicates a good condition and the carousel is functioning normal.
  - **Paused** indicates that the carousel has been halted by the user through the instrument firmware.
  - **Terminated** indicates that carousel movement has failed.
  - **Carousel Jam** indicates the reader is not running due to a carousel jam.
  - **Load Jam** indicates the reader is not running due to an autoloader failure.
  - **UnLoad Jam** indicates the reader is not running due to an unload into stacker jam.
  - **Processing Jam** indicates the reader is not running due to a reader or optical failure.

- ◊ **Max Down Tim** indicates the reader has been jammed for over 24 hours and all cards are terminated.
- ◊ **Fatal Jam** indicates the firmware is lost and power to the instrument needs to be cycled.
- ◊ **Booting** indicates the initialization of the instrument.

SEQ_STATUS_RESET

SEQ_STATUS_RESET zeros the Total Cycles, Total Retries and Total Failures in SEQ_STATUS. If SEQ_STATUS_RESET is entered, 'WARNING: SEQ A Status Non Volatile Values will be changed!' will be displayed and will ask 'Do you wish to continue (Y/N):' If Y is entered, Total Cycles, Retries, and Total Failures will be set to 0.

SEQ_PAUSE

SEQ_PAUSE will stop the carousel processing. Cards will not be read.

SEQ_RESUME

SEQ_RESUME will restart the carousel processing, if currently in a paused condition. Cards will begin to be read.

EJECTOR_INIT

EJECTOR_INIT initializes the ejector to its ejector home sensor. (If the cycle is completed without errors, no message will be displayed.)

EJECTOR_CYCLE

EJECTOR_CYCLE performs an ejector cycle.

CAM_CYCLE

CAM_CYCLE performs a cam cycle.

STACKER

STACKER_INIT

STACKER_INIT initializes the push plate to its stacker push plate home sensor. (If the cycle is completed without errors, no message will be displayed.)

STACKER_CYCLE

STACKER_CYCLE performs a stacker cycle.

FLASH LOG

The instrument log is located on the Bay Controller Board (BCB) and is stored in the flash memory. It can include up to 128k of data. Once the flash log is full, the oldest logged information will be overwritten. Each line of the flash log is formatted the same way and includes a variety of information such as instrument communication, processing, alarms, doors opening, user interface entry, interment power up and firmware updates.

The first entry on each flash log line is either ALM or LOG. An ALM line indicates an alarm message that occurred on the instrument. A LOG line details instrument activity not generating alarm messages. (There may be a LOG line before or after the ALM line with detailed information for troubleshooting.)

The time stamp is the second entry on each flash log line. This is when the LOG or ALM occurred, referencing a 24 hour clock that starts each time the instrument is turned on. The time stamp is displayed in Days::Hours:Minutes:Seconds.Milliseconds.

Following the time stamp is a description of the LOG or ALM.

FLASH_LOGS

FLASH_LOGS will list all log messages contained in the flash memory of the Bay Controller Board, starting from the earliest logged message it has in flash to the last. There are two options with this command, FLASH_LOGS 0 and FLASH_LOGS 1. FLASH_LOGS 0 will allow the log messages to scroll without stopping. FLASH_LOGS 1 will allow the log messages to scroll with page stops. (The entire log can be captured by a communications software package or by Enable Logging on the diagnostics terminal.)

FLASH_LOG_TAIL

FLASH_LOG_TAIL will list the number of specified lines, staring from the most recent logged messages contained in the flash memory of the Bay Controller Board. For example, FLASH_LOG_TAIL 10 will list the last 10 logged messages entered into the flash memory of the Bay Controller Board. Figure 6-30 shows a example of FLASH_LOG_TAIL 10.

```
VTK2 A > FLASH_LOG_TAIL 10
Logs 10 of 902
LOG: 12::21:10:36.696 LCD Error Log
LOG: 12::21:56:53.272 Door closed with new cassette, Signaling start SINGLE process....
LOG: 12::21:56:59.288 SPNLOG Motor home failure: Right Transport of 20 steps
LOG: 12::21:57:22.816 CASSETTE LOAD'004:EP' 'Real' Vac 1, Seal 1, Mode 0 Cards 3: 0A0A0A000000000
LOG: 12::22:00:19.968 SPNLOG Motor home failure: Right Transport of 16 steps
LOG: 12::22:02:29.248 Door closed with new cassette, Signaling start SINGLE process....
LOG: 12::22:02:34.648 SPNLOG Motor home failure: Right Transport of 20 steps
LOG: 12::22:02:59.584 CASSETTE LOAD '002:EP ' 'Real' Vac 1, Seal 1, Mode 0 Cards 6: 0A0A0A0A0A0A000
LOG: 12::22:03:13.152 SEQ head A is starting autoloader sequence...
LOG: 12::22:03:33.144 SEQ head A is Resuming Processing from autoloader sequence...
```

Figure 6-30 FLASH_LOG_TAIL

FLASH_LOG_BOOT

FLASH_LOG_BOOT will list all boot times in flash memory of the Bay Controller Board and all logged messages since the last instrument boot. See Figure 6-31.

```
VTK2 A > flash_log_boot
LOG: 00::00:00:01.022 EBOOT ***** Time: Thu Jul 08 10:55:08 1999 *****
LOG: 00::00:00:01.022 EBOOT ***** Time: Thu Jul 15 08:44:30 1999 *****
LOG: 00::00:00:01.022 EBOOT ***** Time: Thu Jul 15 09:22:50 1999 *****
LOG: 00::00:00:01.022 EBOOT ***** Time: Fri Jul 16 13:42:47 1999 *****
LOG: 00::00:00:01.022 EBOOT ***** Time: Fri Jul 16 14:33:14 1999 *****
Logs 99 of 924
LOG: 00::00:00:01.022 EBOOT ***** Time: Fri Jul 16 14:33:14 1999 *****
LOG: 00::00:00:01.042 NSB Firmware.  BCB 4: Version: BOOT: 04.03: Mar 30 1998
LOG: 00::00:00:01.167 BOOT Touch Serial Number Verifies
LOG: 00::00:00:36.823 BOOT FLASH 'Log File' Verified with 805 Logs and 20 Alarms Messages
LOG: 00::00:00:00.063 BOOT Touch Serial Number Verifies
LOG: 00::00:00:00.087 FBOOT ***** Time: Fri Jul 16 14:33:51 1999 Pilot49 *****
LOG: 00::00:00:00.102 NSB Firmware.  BCB 4: Version: BCB:02.27:Jun 30 1999
LOG: 00::00:00:00.528 BOOT FLASH 'WellMaps' Verified with 40 Well Maps
LOG: 00::00:00:01.207 NWK Node: 2: Left Transport was AutoDetected
LOG: 00::00:00:01.332 NWK Node: 3: Right Transport was AutoDetected
LOG: 00::00:00:01.458 NWK Node: 4: Diluter was AutoDetected
LOG: 00::00:00:01.583 NWK Node: 5: Pipetter was AutoDetected
LOG: 00::00:00:01.707 NWK Node: 6: VacuSealer was AutoDetected
LOG: 00::00:00:01.831 NWK Node: 7: Reader A was AutoDetected
LOG: 00::00:00:01.923 BOOT FLASH 'Log File' Verified with 809 Logs and 20 Alarms Messages
LOG: 00::00:00:02.956 NWK Node: 8: Carousel A was AutoDetected
LOG: 00::00:00:02.571 NWK 7 Nodes were AutoDetected
```

Figure 6-31 FLASH_LOG_BOOT

FLASH_LOG_GREP

FLASH_LOG_GREP will search for specific text from the flash log and display the corresponding lines found. The text being searched should follow the FLASH_LOG_GREP command and is case sensitive. For example 'FLASH_LOG_GREP PIP' will list all logged messages containing "PIP" in its text and 'FLASH_LOG_GREP Pip' will list all logged messages containing "Pip". A line number is displayed at the beginning logged message found. This number can be used in conjunction with FLASH_LOG_TAIL to find the logged lines in the same time frame. Figure 6-32 shows a example of FLASH_LOG_GREP.

```
VTK2 A > FLASH_LOG_GREP PIP

0252 LOG: 00::00:00:01.112 FBOOT ***** Time: Mon Nov 30 10:27:06 1998 Rotterdam *****
0353 LOG: 02::02:23:22.117 PIP/DIL responce error: 0x94 'Pipetter PT reading with fluid was too low'
0356 LOG: 02::02:23:23.190 PIP/DIL Error, terminating card: '0761243300004396'
0492 LOG: 10::05:31:40.197 PIP/DIL responce error: 0x50 'Diluter max. timeout exceeded'
0495 LOG: 10::05:31:40.290 PIP/DIL Error, terminating card: '0761243300004408'
0496 LOG: 10::05:32:10.512 PIP/DIL responce error: 0x50 'Diluter max. timeout exceeded'
0499 LOG: 10::05:32:10.605 PIP/DIL Error, terminating card: '0761243300004505'
```

Figure 6-32 FLASH_LOG_GREP

SAMPLE PREP NODE BOARDS

NODE_STATUS

NODE_STATUS will display all SPN Board node numbers, location, status, and version. If the status of SPN Board is 'DISABLED', then it has not been detected by the instrument. Figure 6-33 shows a example of NODE_STATUS.

```
# :           Node :   Status :Temp *F :Seq Num :Seq Num : Zero Errors : CS Errors : Version
 2  Left Transport :  ENABLED :    103 :    124 :    123 :           0 :         0 : 01.61  18-11-1997
 3 Right Transport :  ENABLED :    103 :    189 :    204 :           0 :         0 : 01.61  18-11-1997
 4         Diluter :  ENABLED :    103 :     88 :     87 :           0 :         0 : 01.61  18-11-1997
 5        Pipetter :  ENABLED :    103 :    109 :    108 :           0 :         0 : 01.61  18-11-1997
 6      VacuSealer :  ENABLED :    103 :    101 :    103 :           0 :         0 : 01.58  23-10-1997
 7        Reader A :  ENABLED :    103 :    150 :    157 :           0 :         0 : 01.61  18-11-1997
 8      Carousel A :  ENABLED :    103 :    238 :    237 :           0 :         0 : 01.61  18-11-1997
 9        Reader B : DISABLED :      0 :      1 :      0 :           0 :         0 : unknown
10      Carousel B : DISABLED :      0 :      1 :      0 :           0 :         0 : unknown
11          unused : DISABLED :      0 :      1 :      0 :           0 :         0 : unknown
```

Figure 6-33 NODE_STATUS

$CUR_NODE

$CUR_NODE indicates the current node for specific commands to apply such as SPN_SENSORS and SPNVAR_SHOW. Because this command begins with a '$', it is a variable and has a value assigned to it. To determine its value, and therefore the current node, it is necessary to enter PR before the command.

The value of $CUR_NODE can be changed by first entering NODE_STATUS to reference the node numbers. Then assign the desired value to $CUR_NODE. For example, if it was desired to make the Diluter SPN Board the current node, type $CUR_NODE=4 and press ENTER. (Note: A short command is NODE X, where X equals the node to address.)

Another means of performing the same function as the $CUR_NODE command is to enter one of the following commands from Table 6-2.

Table 6-2 Node Addressing

N_FTRANS	(Front/Left Transport SPN board)
N_LTRANS	(Front/Left Transport SPN board)
N_BTRANS	(Back/Right Transport SPN board)
N_RTRANS	(Back/Right Transport SPN board)
N_DIL	(Diluter SPN board)
N_PIP	(Pipettor SPN board)
N_VAC	(VAC/SEAL SPN board)
N_SEAL	(VAC/SEAL SPN board)
N_AL	(Reader SPN board)
N_CAM	(Reader SPN board)
N_STACKER	(Reader SPN board)
N_READER	(Reader SPN board)
N_CARO	(Carousel SPN board)
N_INCU	(Carousel SPN board)
N_EJECTOR	(Carousel SPN board)

SPN_SENSORS

SPN_SENSORS can be used to diagnose optical switch sensors. For example, if it was necessary to verify the instruments right lid sensor was working, first the Right Transport SPN Board should addressed as the current node. Then after the SPN_SENSORS command is executed a table describing the connector location on the SPN Board plus the present state of the sensor will be displayed. See Figures 6-34 to 6-40.

```
J1:              Left Transport Motor   -
J2:                 Left Paddle Motor   Home
J3:                Front Paddle Motor   Home
J4:                       Boat Sensor   clear
J14:                         Left Lid   closed
J15:             Front Transport Motor   -
J16:           Front Transport Encoder   clear
```

Figure 6-34 SPN_SENSORS for Node 2 - Front/Left Transport SPN

```
J1:              Right Transport Motor   -
J2:                 Right Paddle Motor   Home
J3:                  Back Paddle Motor   Home
J4:                    Cassette Sensor   clear
J9:                          Right Lid   closed
J15:               Back Transport Motor   -
J16:             Back Transport Encoder   clear
```

Figure 6-35 SPN_SENSORS for Node 3 - Back/Right Transport SPN

```
J3:                           Tilt Motor   -
J15:                          Pump Motor   Home
```

Figure 6-36 SPN_SENSORS for Node 4 - Diluter SPN

```
J1:                            Tip Motor   Home
J2:                          Rotor Motor   Home
J3:                           Drum Motor   Home
J4:                           Pump Motor   -
J15:                       Vertical Motor   Home
```

Figure 6-37 SPN_SENSORS for Node 5 - Pipettor

```
J3:                        Sealer Flag   clear
J15:                     Chamber Motor   Home
J16:                   Chamber Encoder   clear
```

Figure 6-38 SPN_SENSORS for Node 6 - Vac/Seal SPN

```
J1:                       Stacker Motor   Home
J2:                           Cam Motor   Home
J3:              Optical Shuttle Motor   Home
J4:                        Loading Door   closed
J9:                  Front Access Panel   closed
J14:                        Card Sensor   clear
J15:                   Autoloader Motor   Home
J16:                             Stacker   empty
J19:                        Stacker Tray   present
```

Figure 6-39 SPN_SENSORS for Node 7/9 - Reader (A/B)

```
J1:                     Incubator Cover   closed
J2:                      Carousel Motor   -
J3:                       Ejector Motor   Home
J14:                      Caro Top Index   blocked
J16:                   Caro Bottom Index   blocked
```

Figure 6-40 SPN_SENSORS for Node 8/10 - Carousel (A/B)

MOTORS

MN

MN will address a specified motor. It is necessary to specify the motor name after this command. MN H will list all of the instrument motor names. See Table 6-3.

NOTE: The reader motor is connected to the head controller board and not accessible through a node. Instead the MOV & DISABLE commands are used.

Table 6-3 Addressing Motors (MN)

VACUUM	Vacuum Vertical Motor
LEFT	Left Transport Pulley Motor
RIGHT	Right Transport Pulley Motor
FRONT	Front Transport Pulley Motor
BACK	Back Transport Pulley Motor
LPADDLE	Left Transport Paddle Pulley Motor
RPADDLE	Right Transport Paddle Pulley Motor
FPADDLE	Front Transport Paddle Pulley Motor
BPADDLE	Back Transport Paddle Pulley Motor
TILT	Diluter Pivoting (tilt) Pulley Motor
DPUMP	Diluter Pump Motor
DRUM	Pipettor Direct Drive Drum Motor
TIP	Pipettor Tip Motor
ROTOR	Pipettor Pivoting (Rotor) Pulley Motor
PPUMP	Pipettor Pump Motor
VERT	Pipettor Vertical Pulley Motor
AUTOLOADER	Autoloader Motor
SHUTTLE	Fluorescence Shuttle Motor
STACKER	Card Stacker Motor
CAM	(Reader) Cam Motor
CAROUSEL	Carousel Motor
SEALER	Sealer Motor
EJECTOR	Card Ejector Motor

HOME

HOME will home the current motor. See the MN command.

IN

IN will move the current motor the specified number of steps. See the MN command.
Example: VTK2 A > IN 50

OUT

OUT will move the current motor the specified number of steps. See the MN command.
Example: VTK2 A > OUT 50

MOTOR_OFF

MOTOR_OFF will turns the current motor off. See the MN command.

MOV

MOV is specifically used to move the reader motor in a positive or negative direction and requires a specified number of steps. To move a card completely through the reader, the reader motor will make 1500 steps. For example, to move the reader motor clockwise toward the carousel, type MOV 1500. To move the reader motor counterclockwise toward the waste collection tray, type MOV –1500.

WARNING! The motor phases are locked after the MOV command is given. When finished with this command, the operator **MUST** type **DISABLE** to disable the lock.

DISABLE

DISABLE is used specifically used to unlock the reader motor phases after the MOV command has been given.

FIRMWARE

VER

VER will display the installed versions of the BCB, BOOT and SPN firmware. Figure 6-41 shows an example of the ver command.

```
VTK2 A > ver
*** BCB Rev E ***
    Flash Version: BCB:02.26:Feb 19 1999,
Compilation Time: 09:39:01
    BOOT Version: 04.03: Mar 30 1998

*** SPN ***
     Left Transport: 01.61  18-11-1997
    Right Transport: 01.61  18-11-1997
            Diluter: 01.61  18-11-1997
           Pipettor: 01.61  18-11-1997
         VacuSealer: 01.58  23-10-1997
           Reader A: 01.61  18-11-1997
         Carousel A: 01.61  18-11-1997
```

Figure 6-41 VER (Version Information)

- **Flash Version** - Indicates the Bay Controller Board firmware version. This firmware can be updated by using the FILE_REQUEST command or from the User Interface main menu by typing 3476 and pressing **ENTER**.
- **BOOT Version** - Indicates the boot firmware version written on the EPROM chip located on the Bay Controller Board.
- **SPN** - Indicates all the firmware versions of the SPN board controller chips.

FILE_REQUEST

FILE_REQUEST will transfer a file from the Work Station to the instrument Bay Controller Board flash memory. This command can be used for loading new firmware onto the instrument by entering **FILE_REQUEST** followed by **BCB_Firmware.mot**. (The exact case for BCB_Firmware.mot must be entered.) Another way to update the firmware is through the User Interface main menu by typing **3476** and pressing **ENTER**.

XMIT

The XMIT command can resend data stored in the instrument flash memory to the Work Station. There are three options with this command; XMIT 1, XMIT 2 and XMIT 3. XMIT 1 will resend all data from the instrument to the Work Station. (This can be used if a hard drive from the Work Station is replaced.) XMIT 3 will resend cassette data specified by a cassette name to the Work Station. (XMIT 2 is used for development purposes only.)

SPNVAR_SHOW

SPNVAR_SHOW will list the SPN board alignments, parameters, and information for a specific node. The alignment variables are set while performing the instrument alignment procedure. The parameters are items such as motor speed and tolerances. Information are items such as firmware versions and compile dates. There are 10 options used with this command. To list all of them type **SPNVAR_SHOW h** and press **ENTER**. Refer to Figure 6-42 for the 10 options of this command.

WARNING! The flags 'af' are used to download alignments from the BCB to the SPN boards. Doing this will overwrite the existing alignments!

```
VTK2 A > spnvar_show h

Unknown flag 'H'
  a - Alignment Vars
  i - Info Vars
  p - Parametric Vars
  d - Show differences only
  s - Synchronize vars - ask first (will upload or download!)
  f - Fix all differences BCB->SPN (does not ask)
  g - Get vars from SPN boards (does not ask)
  e - Compare against EPROM defaults, not NV data
  n - Nonstop display (no screen pauses)

To display all changeable variables use 'ap'
To narrow down to those that are changed use 'apd'
```

Figure 6-42 SPNVAR_SHOW

Example 1:
To list all alignment variable relating to the Vacuum SPN Board, it is necessary to first enter **N_VAC** to point to the current board and then enter **SPNVAR_SHOW A**.

```
VTK2 A > N_VAC

VTK2 A > SPNVAR_SHOW A
NV data stored at Wed Nov 04 13:41:52 1998
------ VacuSealer ----------
138                    Vac Touch Pos :A:  2901  (2855) ***
161                Vac Fine Holdpoint :A:    94  (100) ***
Motor           Vacuum -      Home Offset :A:     0
Motor           Sealer -      Home Offset :A:     0
```

Figure 6-43 SPNVAR_SHOW Alignment for Vac/Seal SPN

NOTE: The *** that appear to the far right indicate that this alignment differs from the stored alignment in the Bay Controller Board. This will cause the instrument alarm "**Hardware Error: Internal Data Failure: 169**". If this is the case, it is necessary to enter the SAVE_ALIGNMENT macro.

Example 2:

To list all parameters relating to the Vacuum SPN Board, it is necessary to first enter **N_VAC** to make it the current board and then enter **SPNVAR_SHOW P**.
See Figure 6-44.

```
VTK2 A >  n_vac

VTK2 A > spnvar_show p
NV data stored at Thu Jul 15 09:23:49 1999
------ VacuSealer ----------
  5                      Debug Flags :P:   255
130       Sealer On Time (10th secs) :P:    35
131      Sealer Off Time (10th secs) :P:    15
132       Sealer Preheat Time (secs) :P:     7
133                 Sealer Up Offset :P:     0
134               Sealer Down Offset :P:     0
135                Vac Encoder Limit :P:    40
136                        Vac Speed :P:    70
137                  Vac Touch Speed :P:    25
139                  Vac Down Offset :P:   100
140                    Vac Read Mult :P:    71
141                  Vac Read Offset :P:   130
142                    Vac Hold Time :P:     5
143                   Vac Mode Point :P:    30
144                   Vac Down Slope :P:    65
145                Vac Down Increment :P:    10
146                      Vac Up Slope :P:    65
147                  Vac Up Increment :P:     4
148              Vac Prop Cal Offset :P:    15

Press any key to continue...
```

Figure 6-44 SPNVAR_SHOW P (Parameters for Vac/Seal SPN)

SPNVAR_SHOW_ALL

SPNVAR_SHOW_ALL will list all SPN board alignments, parameters, and information just like SPNVAR_SHOW, except no node needs to be addressed. (The same flags are used.) See SPNVAR_SHOW.

MACROS

MAC

MAC will list all macros contained in instrument memory. A macro is a small program that allows multiple commands to be combined into one. For example, DIL_CYCLE is a macro that will execute the DIL_FILL and DIL_EMPTY commands. See Figure 6-45.

```
VTK2 A > mac

        Existing Macros:
CMD = netsends $cur_node 30000 $$ 1 #
CMD1 = netsends $cur_node 30000 $$ 1 $$ #
NODE = $cur_node=($$)
CCB = netsends 8 20000 121 1 $$ 2 #
CCJ = netsends 8 20000 122 1 0 $$ #
DIL_CYCLE = dil_fill dil_empty
DIL_SCAN = n_dil $a=-8 mot 9 loop 21 { pr "Pos: $a =  " moveto $a pr $sv_adc.2 out 25 cr wait
10 inc $a } pr "air = $sv_adc.2" motof
DIL_CHECK = n_dil cmd 65
INIT = KILL KILL
B_CODE = loopx 1 15 ( $a=i cmd1 156 $a bar )
SAVE_ALIGNMENT = spnvar_show_all adgn
SHOW_ALIGNMENT = spnvar_show_all an
RESTORE_ALIGNMENT = spnvar_show_all afn
SEAL_TEST = test_sealer
FIX_SPN_PARAMS = SPN_PARAM_DEFAULTS SPNVAR_SHOW_ALL pdfn
DILBERT = dil_fill dil_down wait 10 dil_empty
TX_TEST = $b=$dml_log_en $dml_log_en=1 $a=$$ debug "- all + TRN:7" unkill calwave $a kill cr
tx_go $dml_log_en=$b
TX_GO = $screen_dump=5 pr "Initial Read" cr readwave $a cr tx_burn $a 112 3400 50 60 0 cr pr
"Final Read" cr readwave $a
FL_TEST = fl_test_autodetect fl_init cal_ref 3500 50 cal_offset 10 2 0
FL_CAL = eshuttle cal_gain 3000 50 hshuttle cal_softoffset
F1 = warm_lamp 50 $screen_dump=3 eshuttle readrow 1 1 1 hshuttle
F2 = warm_lamp 50 $screen_dump=3 hshuttle readrow 1 1 1
INT_NOISE = fl_opt_int 0 $a=$fl_sema_hits warm_lamp 100 $b=($fl_sema_hits-$a) pr "Errors:" pr
$b cr

  Percent Used: 60
```

Figure 6-45 MAC

INIT

The INIT macro is executed each time the instrument is powered on. This macro is similar to the Autoexec.bat macro that is used in DOS.

ED

ED allows editing of an existing macro.
Example: VTK2 A > ED DIL_CYCLE
Edit> DIL _INIT DIL _FILL DIL_EMPTY
saving. . .

SETMAC

SETMAC can be used to create a macro.
Example: VTK2 A > SETMAC PIP_CYCLE PIP_GET 100 PIP_PUT
(A macro called PIP_CYCLE will now be listed with the other instrument macros and can be vied by entering MAC.)

DELMAC

DELMAC will delete a specified macro
Example: VTK2 A > DELMAC PIP_CYCLE
Macro deleted.

CLEAR_ALL_MACROS

CLEAR_ALL_MACROS will delete all macros.

REFRESHMAC

REFRESHMAC will restore all default macros

SAVE_ALIGNMENT (macro)

SAVE_ALIGNMENT is a macro that will save all alignments from the SPN Boards to the Bay Controller Board. Failure to enter this command after an alignment has been changed will generate the instrument alarm "Hardware Error: Internal Data Failure: 169". (See the SPNVAR_SHOW and SPNVAR_SHOW_ALL command for related information.)

WARNING! If a SPN chip is replaced without previously saving the alignment variables to the BCB, the corresponding section of the instrument will need to be realigned.

RESTORE_ALIGNMENT (macro)

RESTORE_ALIGNMENT is a macro that will restore all saved alignment variables from the Bay Controller Board to the SPN Boards. If a new SPN chip is installed, entering this command will reload the alignment variables onto the SPN chip without having to realign the instrument. (See the SPNVAR_SHOW and SPNVAR_SHOW_ALL command for related information.)

TX_TEST (macro)

TX_TEST is a macro that will test the transmittance optics. It is necessary to enter the optics number after this command. For example, TX_TEST 1 for transmittance optic 1 and TX_TEST 2 for transmittance optic 2.

WARNING! This command should only be used when cards are not processing or a SEQ_PAUSE is invoked

SYSTEM

COLD

COLD will reboot the instrument. This command is prioritized by the data manager. If there is any process that has a higher priority, it will perform those tasks first before rebooting.

HARDCOLD

HARDCOLD immediately does a reboot without allowing the firmware to perform higher priority tasks**. The COLD command should always be used, otherwise data from processing cards could be lost.**

ALARMS

The ALARMS command displays the current instrument alarms from the message/error alarm queue.

CLEAR_ALARMS

CLEAR_ALARMS will clear all the alarms from the message/error alarm queue. (Note: If the user interface screen is displaying the alarms when this command is executed, the alarms will remain in the queue.)

MESSAGES

MESSAGES will display all the historical alarms since the last power-up of the instrument.

INST_DEFAULTS

INST_DEFAULTS will set all instrument variables to their production default values. When the INST_DEFAULTS command is executed, 'WARNING: Setting ALL Instrument VARIABLES to there default setting. Do you wish to continue (Y/N):' will be displayed. Pressing Y will default the instrument settings.

NOTE: If any variables have been changed on a instrument during troubleshooting, INST_DEFAULTS followed by a COLD should always be executed prior to leaving DML.

The parameters changed are:

```
Development mode is turned off.        Boat management is enabled.
Range of motion is enabled.            Real load mode is enabled.
Door cassette sensors are enabled.     Cassette mode is set to SCS.
Dilution mode is set to Automatic.     Temperature alarm is enable.
Bar code is enabled.                   Diluter is enabled.
Pipettor is enabled.                   Vacuum is enabled.
Sealer is enabled.                     Stacker is enabled.
Autoloader is enabled.                 Transmittance 1 is enabled.
Transmittance 2 is enabled.            Transmittance 3 is disabled.
Fluorescence is enabled.               Communications is enabled.
Audible alarm is enabled.              Visual alarm is enabled.
Burn-in is disabled
```

COMP_STATUS

COMP_STATUS indicates the number of cycles performed on the Vacuum, Sealer, Pipettor, and Diluter and if any failures have occurred. It displays the version of bar code reader, the number of Power Fail and Low Battery signals from the instrument UPS, the quantity of saline dispenses and pipettor tips the firmware believes are available in the instrument, the current duty cycle of the exhaust fans located on the back of the instrument, the total number of cards read by the instrument, and the total number of boats processed. See Figure 6-46.

```
VTK2 A > comp_status
Component |   NVStatus |   Cycles | Failures
Vacuum:        ENABLED |     1163 |        3
Sealer:        ENABLED |     1360 |        0
Pipettor:      ENABLED |     8166 |        0
Diluter:       ENABLED |     8169 |        2

BarCode:       ENABLED: Version 2

Stacker A:     ENABLED
AL A:          ENABLED
TX1A:          ENABLED
TX2A:          ENABLED
TX3A:         DISABLED
FLRA:          ENABLED

Low Batt Signals: 1
Power Fail Signals: 1

Diluent level: 350/350 (100%)
Tip  Count:    350/350 (100%)
Exhaust Fan Duty Cycle: 0
Total Cards Cycled: 4170
Total Boats Cycled: 2923
```

Figure 6-46 COMP_STATUS

COMP_STATUS_RESET

If COMP_STATUS_RESET is entered, it will display 'WARNING: Resetting System Status Registers' and ask 'Do you wish to continue (Y/N):'. If Y is entered, the cycles and failures for the Vacuum, Sealer, Pipettor, and Diluter, the number of Power Fail and Low Battery signals from the instrument UPS, and the total number of cards reads by the instrument will be set to 0. To zero the total number of boats processed, it is necessary to use the BOAT_STATUS_RESET command.

COM_STATUS

COM_STATUS indicates the status of communication between the instrument and the Work Station. If TPL Unsent Commands is greater than 0, this will indicate that the instrument is trying to send information to the Work Station, but the Work Station is not receiving these commands. This could be a problem with either the instrument or the Work Station. Figure 6-47 shows a example of COM_STATUS.

```
VTK2 A > COM_STATUS

Communication Status             : Host Computer

BCB Stats...
    TPL Total Sent Commands      : 2323
    TPL MAX Unsent Commands      : 14
    TPL Unsent Commands          : 0

    APL Total Processed Commands : 65
    APL MAX Unprocessed Commands : 26
    APL Unprocessed Commands     : 0

TPL Stats...
    Total ACKs Sent      : 133
    Total ACKs Received  : 4667
    Total NAKs Sent      : 0
    Total NAKs Received  : 0
    Total ENQs Sent      : 2351
    Total ENQs Received  : 85
    Total CANs Sent      : 3
    Total CANs Received  : 0

Host Stats...
    Name          : MarcySecret
    Serial Number : 52b3f8004b20

            File Name | Type |   Chunks |    Size | Check Sum | Elapsed Time
```

Figure 6-47 COM_STATUS

$HOST_COM_EN

$HOST_COM_EN enables/disables the communication from the instrument to the Work Station. This is a variable that is stored in non-volatile memory. To determine its value, it is necessary to enter PR before the command. If a 1 is displayed, communication is enabled. Typing **$HOST_COM_EN=0** and pressing **ENTER** will disable the communication. **For proper instrument operation it is imperative that the communication is enabled prior to exiting DML.** To accomplish this use the command $HOST_COM_EN=1 or INST_DEFAULTS.

$TIME

$TIME displays the BCB time since it was first turned on. This actually begins when the BCB is tested at the manufacturer, before it is placed in the instrument. (This is the time stamp that is sent to the Work Station, so it can sort out new vs. old data.) Because this command begins with a '$', it is a variable and has a value assigned to it. To determine its value, it is necessary to enter PR before the command. The output will be displayed in Year:Days::Hours:Minutes:Seconds: Milliseconds.

TIME

TIME is a command and displays the RTC time, the current time and the sys time.

SYS_STATUS

SYS_STATUS displays installed instrument components and any errors associated with those components. Figure 6-48 is a example of SYS_STATUS with two errors. These errors codes are 202 and 204. It indicates that the Transmittance 2 and Fluorescence Optics have not been detected by the instrument firmware. (Refer to Appendix D for more details.) If there is an error code listed in the Error Codes column, the instrument will display a status of 'Errors' on the User Interface screen until the error has been corrected.

```
VTK2 A > sys_status
     Component | Installed | Functional | Error Codes
     Reader A  |       Yes |        Yes |
    Stacker A  |       Yes |        Yes |
 Autoloader A  |       Yes |        Yes |
  Incubator A  |       Yes |        Yes |
   HCB Head A  |       Yes |        Yes |
  TX 1 Head A  |       Yes |        Yes |
  TX 2 Head A  |        No |         No |202
  TX 3 Head A  |        No |         No |
    FL Head A  |        No |         No |204
     Reader B  |        No |         No |
    Stacker B  |        No |         No |
 Autoloader B  |        No |         No |
  Incubator B  |        No |         No |
   HCB Head B  |        No |         No |
  TX 1 Head B  |        No |         No |
  TX 2 Head B  |        No |         No |
  TX 3 Head B  |        No |         No |
    FL Head B  |        No |         No |
      Diluter  |       Yes |        Yes |
     Pipettor  |       Yes |        Yes |
       Vacuum  |       Yes |        Yes |
       Sealer  |       Yes |        Yes |
    Transport  |       Yes |        Yes |
 Touch Memory  |       Yes |        Yes |
     Bar Code  |       Yes |        Yes |
  Inside Temp  |       Yes |        Yes |
    Host Comm  |       Yes |        Yes |
   Power Fail  |       Yes |        Yes |
     Low Batt  |       Yes |        Yes |
```

Figure 6-48 SYS_STATUS

The following variables can be used to enable or disable the corresponding instrument component or section. To enable the component or station, type the variable followed by =1 and press ENTER. To disable the component or station, type the variable followed by =0 and press ENTER. Example: VTK2 A > $DILUTER_EN=0

$BARCODE_EN	**$DILUTER_EN**	**$PIPETTER_EN**
$VACUUM_EN	**$SEALER_EN**	**$TX1_EN**
$TX2_EN	**$FLR_EN**	**$AUTOLOADER_EN**
$STACKER_EN		

$SERIAL_NUMBER

$SERIAL_NUMBER will display the Bay Controller Board serial number. Because this command begins with a '$', it is a variable and has a value assigned to it. To determine its value, it is necessary to enter PR before the command.

Example: VTK2 A > PR $SERIAL_NUMBER
000001FD4078

JUMPER

JUMPER will display the Bay Controller Board jumper configuration for HDR8. Figure 6-49 gives an example of the JUMPER command. The asterisks in the far right column indicates if a jumper is installed for that specific location. (To set the BCB for a ***VITEK•2®-60***, jumper 0X2000 must be removed. To set the BCB for a ***VITEK•2®-120***, jumper 0X2000 must be installed.)

```
VTK2 A > JUMPER
... Jumper Options ...
  0x0100 : Skip 'INIT' Macro during BOOT
* 0x0200 : LCD Display is installed
  0x0400 : Development System Overide
* 0x0800 : LCD Display Type 5001 or 1013
  0x1000 : ZERO the NV RAM during BOOT
  0x2000 : Vitek II 60 or 120
  0x4000 : Skip FLASH CRC Check during BOOT
  0x8000 : Abort jump to FLASH Code
```

Figure 6-49 JUMPER

WELLMAPS

WELLMAPS will lists all cards that the instrument knows how to process. When the instrument leaves manufacturing, it has a very limited knowledge of specific card wellmaps, therefore the operator is instructed to enter new cards in the Work Station flex panel entry before trying to process them. Once entered, that card type will not need to be entered again unless the BCB and Work Station hard drives are replaced simultaneously.

If the operator tries to process a card that is not listed in WELLMAPS, it will return the cassette back to the load/unload station. An alarm message number 122 “unknown card type” will occur and the instrument will automatically ask the Work Station to send information on how to process that card. The cassette must be removed and then reinserted into the instrument. If the Work Station knows how to process that card and sends it to the instrument, the cards will be processed. If the Work Station does not know how to process the card, the cassette will back to the load/unload station again and the information will need to be entered using the Work Station flex panel entry.

```
VTK2 A > WELLMAPS
Card :       : Pip :
Type :Cycle:Vol:Class:Group:Flex :Well Map Definition                                                                  : Name
   0 :  101:101:    O:    O:   F :11111111 11111111 11111111 11111111 11111111 11111111 11111111 11111111 11111111 : DML 1
   1 :  102:102:    O:    O:   F :11111111 11111111 11111111 11111111 11111111 11111111 11111111 11111111 11111111 : DML 2
   2 :  103:103:    O:    O:   F :11111111 11111111 11111111 11111111 11111111 11111111 11111111 11111111 11111111 : DML 3
   3 :    1:  0:    I:    O:   F :88888888 88888888 88888888 88888888 88888888 88888888 88888888 88888888 88888888 : QC-F
   4 :    1:  0:    I:    O:   F :88888888 88888888 88888888 88888888 88888888 88888888 88888888 88888888 88888888 : Flr Pos Card
   5 :  100:100:    S:    O:   F :11111111 11111111 11111111 11111111 11111111 11111111 11111111 11111111 11111111 : ENG-5
   6 :  100:  0:    S:    O:   F :22222222 22222222 22222222 22222222 22222222 22222222 22222222 22222222 22222222 : ENG-6
   7 :    9:140:    O:    O:   F :33333333 33333333 33333333 33333333 33333333 33333333 33333333 33333333 33333333 : QC-D
   8 :  100:  0:    I:    O:   F :88888888 88888888 88888888 88888888 88888888 88888888 88888888 88888888 88888888 : ENR-8
   9 :  100:  0:    O:    O:   F :33333333 33333333 33333333 33333333 88888888 88888888 88888888 88888888 88888888 : ENR-9
  10 :   13:  0:    I:    N:   F :88888888 88888888 88888888 88888888 88888888 88888888 88888888 88888888 88888888 : ID-GNB
  11 :   27:  0:    I:    P:   F :88888888 88888888 88888888 88888888 88888888 88888888 88888888 88888888 88888882 : ID-GPC
  12 :   61:  0:    I:     :   F :88888888 88888888 88888888 88888888 88888888 88888888 88888888 88888888 88888888 : ID-YST
  13 :   73:  0:    I:     :   F :88888888 88888888 88888888 88888888 88888888 88888888 88888888 88888888 88888888 : ID-ANA
  40 :   73:120:    S:    N:   T :11111111 11111111 11111111 11111111 11111111 11111111 11111111 11111111 11111110 : AST-GN01
  44 :   73:120:    S:    N:   T :11111111 11111111 11111111 11111111 11111111 11111111 11111111 11111111 11111110 : AST-N002
  49 :   73:235:    S:    P:   T :11111111 11111111 11111111 11111111 11111111 11111111 11111111 11111111 11100000 : AST-P504
  59 :   73:235:    S:    P:   T :11111111 11111111 11111111 11111111 11111111 00000000 00000000 00000000 : AST-P506
  60 :   73:235:    S:    P:   T :11111111 11111111 11111111 11111111 11111111 11111111 11111111 11111111 11111110 : AST-P507
  61 :   73:235:    S:    P:   T :11111111 11111111 11111111 11111111 11111111 11111111 11111111 11111111 11111110 : AST-P508
  76 :   73:120:    S:    N:   T :11111111 11111111 11111111 11111111 11111111 11111111 11111111 11111111 11111110 : AST-N009
  77 :   73:120:    S:    N:   T :11111111 11111111 11111111 11111111 11111111 11111111 11111111 11111111 11111110 : AST-N010
  78 :   73:120:    S:    N:   T :11111111 11111111 11111111 11111111 11111111 11111111 11111111 11111111 11111110 : AST-N011
  82 :   73:235:    S:    P:   T :11111111 11111111 11111111 11111111 11111111 11111111 11111111 11111111 11111110 : AST-P515
  83 :   73:235:    S:    P:   T :11111111 11111111 11111111 11111111 11111111 11111111 11111111 11111111 11111111 : AST-P516
```

Figure 6-50 WELLMAPS

Figure 6-50 shows an example of the WELLMAPS and the details are explained below.

- **Card Type** - Indicates the numeric card type.
- **Cycle** - Indicates the maximum number of times that card will read before it ejects.
- **Pip Vol** - Indicates the volume in micro liters that the Pipettor will pipette.
- **Class** - Indicates I for identification, S for susceptibility, O for neither.
- **Group** - Indicates N for gram negative, P for gram positive, O for neither.
- **Flex** - Indicates T if this card was entered through the software flex panel and F if not.

- **Well Map Definition** - Indicates which Optic will read the referenced well.

0 = well will not be read
1 = well read by Transmittance 1
2 = well read by Transmittance 2
4 = well read by Transmittance 3 (Not Available)
3 = well read by both Transmittance 1 & 2
5 = well read by both Transmittance 1 & 3 (Not Available)
6 = well read by both Transmittance 2 & 3 (Not Available)
7= well read by both Transmittance 1, 2 & 3 (Not Available)
8 = well will be read by the Fluorescence Optics
F = well will be read by all the Transmittance & Fluorescence Optics

- Name - Indicates the card name.

ALIGNMENT

Descriptions on the use of the following commands may be found in the ***VITEK•2®*** Alignment Procedure:

ALIGN_MODE_ON	ALIGN_MODE_OFF	ALIGN_FTRANS
ALIGN_BTRANS	ALIGN_LTRANS	ALIGN_RTRANS
ALIGN_BARCODE	ALIGN_DIL_PUMP	ALIGN_DIL_FLUID
ALIGN_DIL_DOWN	ALIGN_VERT	ALIGN_PIP_PUMP
ALIGN_ROTOR_HOME	ALIGN_ROTOR_DOWN	ALIGN_TIP_HOME
ALIGN_TIP_EXT	PIP_POINT	ALIGN_VAC_DOWN
CAL_VAC	ALIGN_SHUTTLE	ALIGN_CAM
ALIGN_AL	ALIGN_MOT	ALIGN_CARO_TOP
ALIGN_CARO_BOTTOM	ALIGN_STACKER	

VITEK•2® Reader General Troubleshooting

Table 6-4 represents general troubleshooting information to be utilized ONLY by an authorized ***VITEK•2***® instrument service representative. All safety and hazard information must be clearly understood and exercised anytime the instrument is serviced.

Table 6-4 General Instrument Troubleshooting Information

MALFUNCTION	GENERAL TROUBLESHOOTING ACTIONS
1. AC power to instrument has failed.	Verify AC power switch is in the "ON" position. Verify the AC line cord is properly connected to the power source. Verify proper voltages at the power source. Check AC power switch fuses in the RFI Filter. Check the AC voltage selector of the RFI Filter. Check fuses in AC Power Supply assembly. Check AC power cord for damage. Verify proper functioning of AC power switch on the instrument. Check output side of RFI filter for proper AC voltage. Replace filter if voltage is incorrect.
2. No power output at AC Power Board.	Check incoming AC power. Check installed fuses. Check Toroid Transformer windings Replace transformer if windings are bad Replace AC power board.
3. No output power supply voltages.	Verify input from AC power board. Replace Power Supply.
4. Power indicators are not lit on BCB board.	Verify incoming AC power to instrument. Verify proper functioning of power supply. Check fuses on the BCB. Replace BCB.
5. No indicator lights are lit on DC power supply board. (for SPN board)	Verify incoming power to board. Verify proper functioning of incoming power supply. Replace DC power supply board.

Table 6-4 General Instrument Troubleshooting Information (con't)

MALFUNCTION	GENERAL TROUBLESHOOTING ACTIONS
6. Transmittance Optical Interrupt failures.	Run **testint** from the instrument diagnostics menu to check the proper functioning of transmittance optical interrupts. Clean both emitter and detector glass of transmittance optics. Replace corresponding transmittance optics based on information attained.
7. Transmittance Calibration errors/ failures.	Clean both emitter and detector glass of transmittance optics. Check flat ribbon cable connection. Run **flash_log_grep CALT** from the instrument diagnostics menu to check the error log for transmittance calibration failures. Run **tx_test X** from the instrument diagnostics menu to test the transmittance optics. (X= the suspected optic 1, 2 or 3) Replace corresponding transmittance optics based on information attained.
8. Reader jamming.	Check integrity of reader head roller plate and belt assembly. Verify proper functioning of reader head motor & pulley. Verify reader head to carousel alignment by checking the home offset, top bias and bottom bias. Refer to Alignment Procedure for details. (See Appendix E - ***VITEK•2®*** Alignment Procedure.) Verify proper functioning of cam assembly. Refer to Alignment Procedure for details. Check carousel quadrant for obstructions. Check waste collection tray for proper alignment. Verify proper functioning of power supply 24 VDC. Replace SPN board for affected transport control.

Table 6-4 General Instrument Troubleshooting Information (con't)

MALFUNCTION	GENERAL TROUBLESHOOTING ACTIONS
9. Carousel jamming.	Verify incubator access cover is properly seated. Verify quadrant is properly seated into carousel hub. Run **caro_init** to check the home carousel sensor (and proper motor operation). Verify reader head to carousel alignment by checking the home offset, top bias and bottom bias. Refer to Alignment Procedure for details. (See Appendix E - ***VITEK•2®*** Alignment Procedure.) Run **ejector_cycle** to verify proper operation of the carousel ejector. Run **cam_cycle** to verify proper operation of the carousel cam. Note: To view the sensor status, first initialize the corresponding node and then run **spn_sensors** (Q to quit). Verify proper functioning of power supply 24 VDC. Replace SPN board for carousel.
10. Incubator Temperature Failures & Errors.	Run **incu_stat** to verify carousel temperatures. Verify integrity and connection of thermistor assembly located inside lower carousel stack. Verify integrity and connection of thermistor assembly located below the heater assembly. Verify integrity of heater assembly located beneath the carousel fan assembly. Verify/replace carousel fans. Verify power supply voltages. Check solid state relay for proper functioning. Replace SPN board affecting control of the incubator.

Table 6-4 General Instrument Troubleshooting Information (con't)

MALFUNCTION	GENERAL TROUBLESHOOTING ACTIONS
11. Ambient temperature out of range.	Check lab for excessively high ambient temperature. Verify/replace fans. (To check fan run **fan 100** and then **fan 0**. Check the integrity of the fan rotation when it stops.) Check for obstructions on the outside of the instrument, verify proper clearances around the instrument. Replace SPN board control. Note: Air flow of fan above Vacuum Assembly should be blowing into instrument. Air flow of fan next to Incubator Assembly should be blowing out of instrument.
12. Drive motor(s) will not operate.	Verify 12v & 24v motor supply voltages on DC power supply board. Verify positioning sensor integrity. Replace affected SPN board control. Replace affected motor.
13. Instrument not communicating messages.	Run **com_status** and look for Communication Status: Host Computer. (If Communication Status is disabled, try running **$host_com_en=1**) Verify RS-232 cable between instrument and computer is connected. Run **VT2SETUP** from the Command Terminal of the Workstation. Check tty configuration. Stop and start instrument deamons. Reboot Workstation. Replace instrument RS-232 cable. Verify power supply voltages on the DC Power Supply Board. Replace BCB board. (See Bay Controller Board (BCB) Replacement)

Table 6-4 General Instrument Troubleshooting Information (con't)

MALFUNCTION	GENERAL TROUBLESHOOTING ACTIONS
14 Diluter System Alarms or Failures.	Check the Sterile Saline Solution Bag is properly installed and full (1000ml). Verify dispenser tube is functioning properly. Replace dispenser tube if necessary. Verify home positioning sensor is functioning. Replace if necessary. Verify there is nothing in the rotational path of the dispenser tube assembly. Verify dispenser tube full sensor is functioning, replace if necessary. Verify motor supply voltages on DC power supply board. Verify and replace diluter pulley motor if required. Verify wiring to the dispenser solenoid is intact. Verify operating of the dispenser solenoid, replace dispenser solenoid. Verify diluter pump and check valve operation. Replace SPN board control.
15. Pipettor Alarms or Failures.	Check the drum for proper amount of tips and fill as necessary. Check straw sensor pad in place and not loose. Verify rotating fingers are functioning properly and delivering tips. Replace rotating finger drive motor if necessary. Verify hollow pipette tip not clogged/bellofram pump and linear actuator functioning. Verify pipettor pivoting home positioning sensor is functioning, replace if necessary. Verify vertical home positioning sensor is functioning, replace if necessary. Verify motor supply voltages on DC power supply board. Verify no obstructions to the vertical column assembly Verify vertical column motor belt is installed/pulley set screws tight. Replace belt and/or tighten pulley set screws. Replace SPN board control.

Table 6-2 General Instrument Troubleshooting Information (con't)

MALFUNCTION	GENERAL TROUBLESHOOTING ACTIONS
16 Vacuum System Alarms or Failures.	Check seal on the top vacuum chamber and clean. Check boat surface and clean. Check solid state relay operation for vacuum pump, replace as necessary. Check voltage available to vacuum pump, replace AC power board as necessary. Check vacuum pump operation, replace pump. Verify vacuum chamber cycles up and down drive screws with no obstructions. Check drive motor belt, pulleys, and motor operation. Replace belt and or motor (ensure proper sync of lead screw position). Replace piping components (tubing & fittings). Replace SPN board control.
17. Sealer Alarms or Failures.	Check cutting wire integrity, replace assembly if necessary. Check Vac/Seal SPN board integrity, replace if necessary.
18. Door/latch problems.	Verify door sensor flag is not bent. Check alignment of sensor flag to optical sensor. Verify proper voltage to door interlock sensors/solenoid while it is energized. Check alignment to the load/unload solenoid door lock plunger to the locking mechanism. Verify proper voltage to load/unload door solenoid while it is energized. For door open message problems, check the wiring of the door interlock sensors. Verify power supply voltages. Replace SPN board control.
19. UPS Failure.	Check AC supply voltage to the UPS. Check and verify communication cables and power cables properly installed.

Motor Number and Name Listing

MOTOR NUMBER	MOTOR NAME *(for DML mn command)*	DESCRIPTION	CONNECTED TO NODE:
0	VACUUM	Vacuum up & down	Filler
1	LEFT	Left Transport Movement	Left Transport
2	LPADDLE	Left Paddle	Left Transport
3	FRONT	Front Transport Movement	Left Transport
4	FPADDLE	Front Paddle	Left Transport
5	RIGHT	Right Transport Movement	Right Transport
6	RPADDLE	Right Paddle	Right Transport
7	BACK	Back Transport Movement	Right Transport
8	BPADDLE	Back Paddle	Right Transport
Diluter			
9	TILT	Tilt	Diluter
10	DPUMP	Pump	Diluter
Pipettor			
11	DRUM	Drum	Pipettor
12	TIP	Tip	Pipettor
13	ROTOR	Rotor	Pipettor
14	PUMP	Pump	Pipettor
15	VERT	Vertical	Pipettor
16	AUTOLOADER	Autoloader	Reader
17	SHUTTLE	Optical Shuttle	Reader
18	STACKER	Stacker	Reader
19	CAM	Cam	Reader
20	CAROUSEL	Carousel	Carousel
21	EJECTOR	Ejector	Carousel
22	SEALER	Sealer up & down	Filler

Appendix A: **Decontamination**

Decontamination Procedure - *VITEK•2®* Integrated System

Decontaminating the *VITEK•2®* instrument

NOTE*:* All decontamination must be done with a 10% bleach solution, using good laboratory practices.

1. Remove and dispose of any remaining accessories kit disposables.

2. Wipe down *all* exterior surfaces.

3. Referring to the ***VITEK•2®*** User's Manual (p/n 510731-x), perform "Cleaning the Boats", Cleaning the Carousel", "Cleaning the Cassettes", "Cleaning the Inside of the ***VITEK•2®*** Instrument" and "Cleaning the Drip Pan".

4. Wipe down interior of all access doors and transport areas including the grooves.

5. Remove any debris from inside the unit and dispose of it in a biohazard bag.

6. Wipe down the base of the carousel, making sure to clean all the way around.

7. Wipe down the interior of the top access doors.

8. Check the decontamination box on the MRA TAG (VTK-777).

Decontaminating Tools

All tools used while servicing the ***VITEK•2®*** should be cleaned using a 10% bleach solution as follows:

1. Moisten a foam or gauze sponge in the bleach solution and wipe all tool surfaces.

2. Allow the bleach solution to react for a minimum of 10 minutes.

3. Wipe off the bleach with water using a moistened foam or gauze sponge. Be certain to rinse all areas thoroughly.

Appendix B: **Schematics and Diagrams**

Figure B-1a shows a block diagram and location of the PC boards inside the ***VITEK•2®*** (60) instrument. Figure B-1b shows a block diagram and location of the PC Boards inside the ***VITEK•2® XL*** (120) instrument.

Vitek 2 PC Board Top Level (60 Unit)

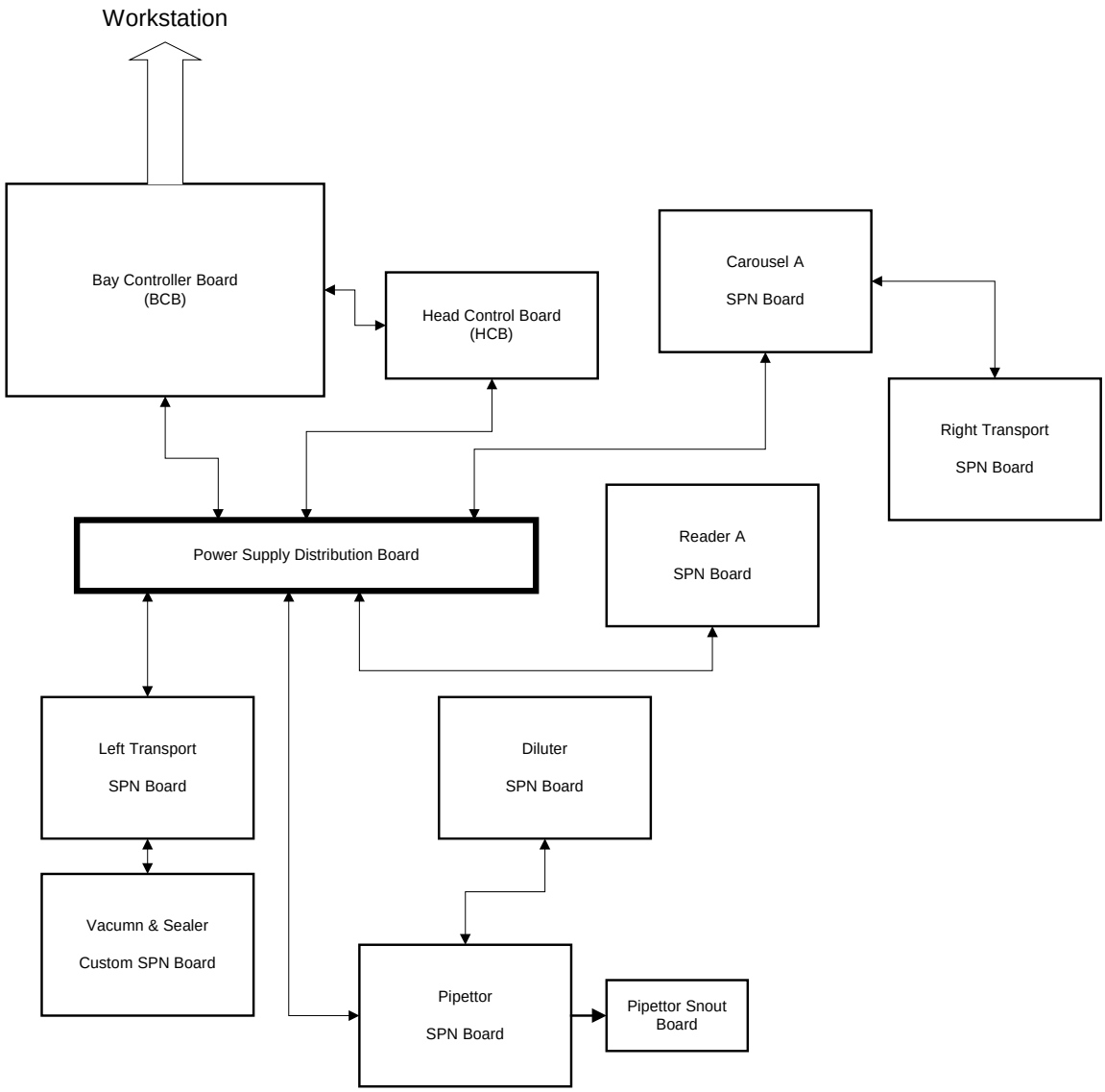


Figure B-1a PC Board Top Level Block Diagram (60)

Vitek 2 PC Board Top Level (120 Unit)

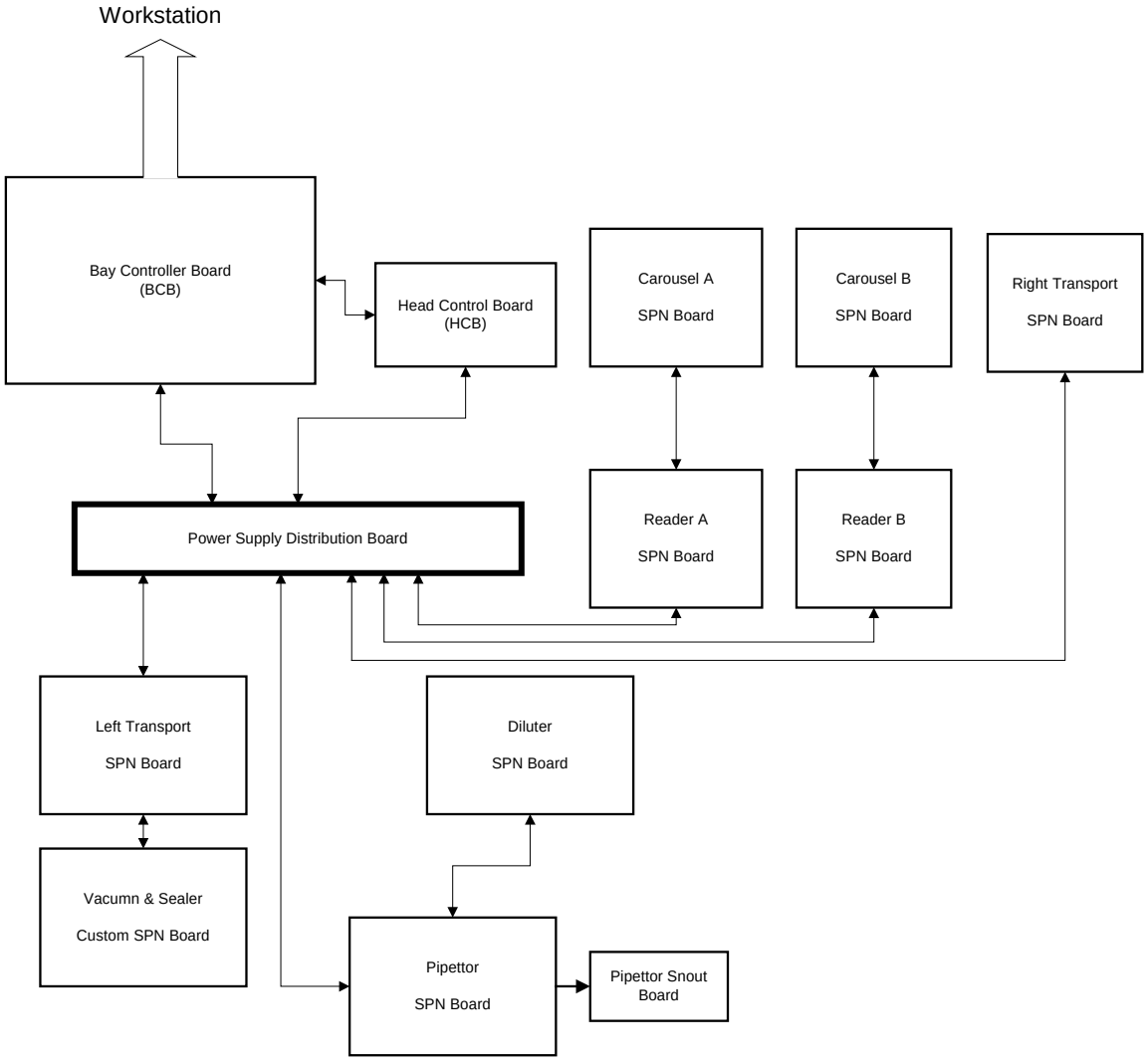


Figure B-1b PC Board Top Level Block Diagram (120)

BCB Board

A Bay Controller Board (BCB) controls the optics, the communications to the workstations, the user interface, and serves as the master controller for the Sample Prep integrated Network (SPN) boards.

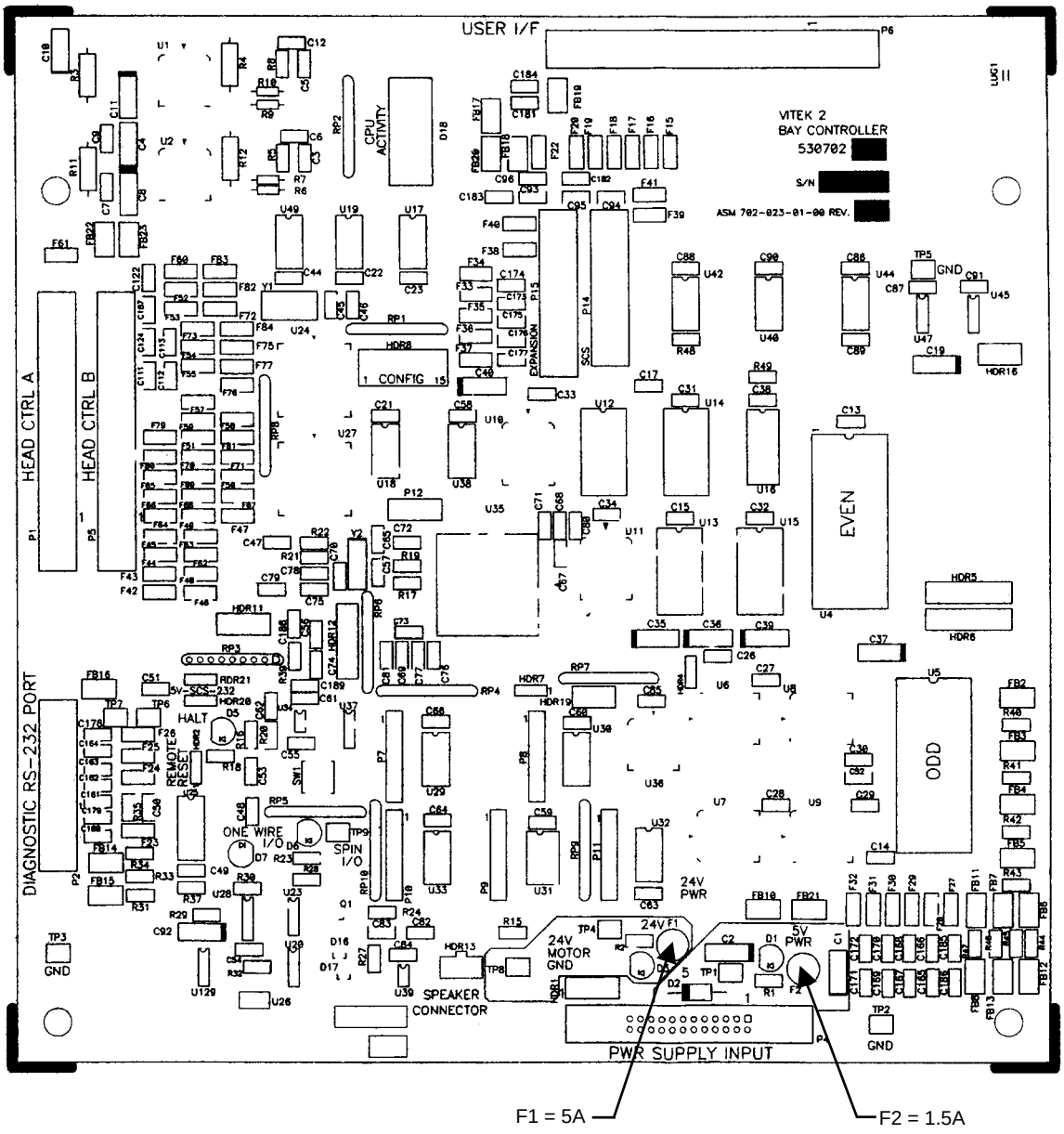


Figure B-2 Bay Controller Board (BCB)

Figure B-3a shows the ***VITEK•2®*** instrument system electronics and the connections to the BCB. Figure B-3b shows the ***VITEK•2® XL*** instrument system electronics and the corrections to the BCB.

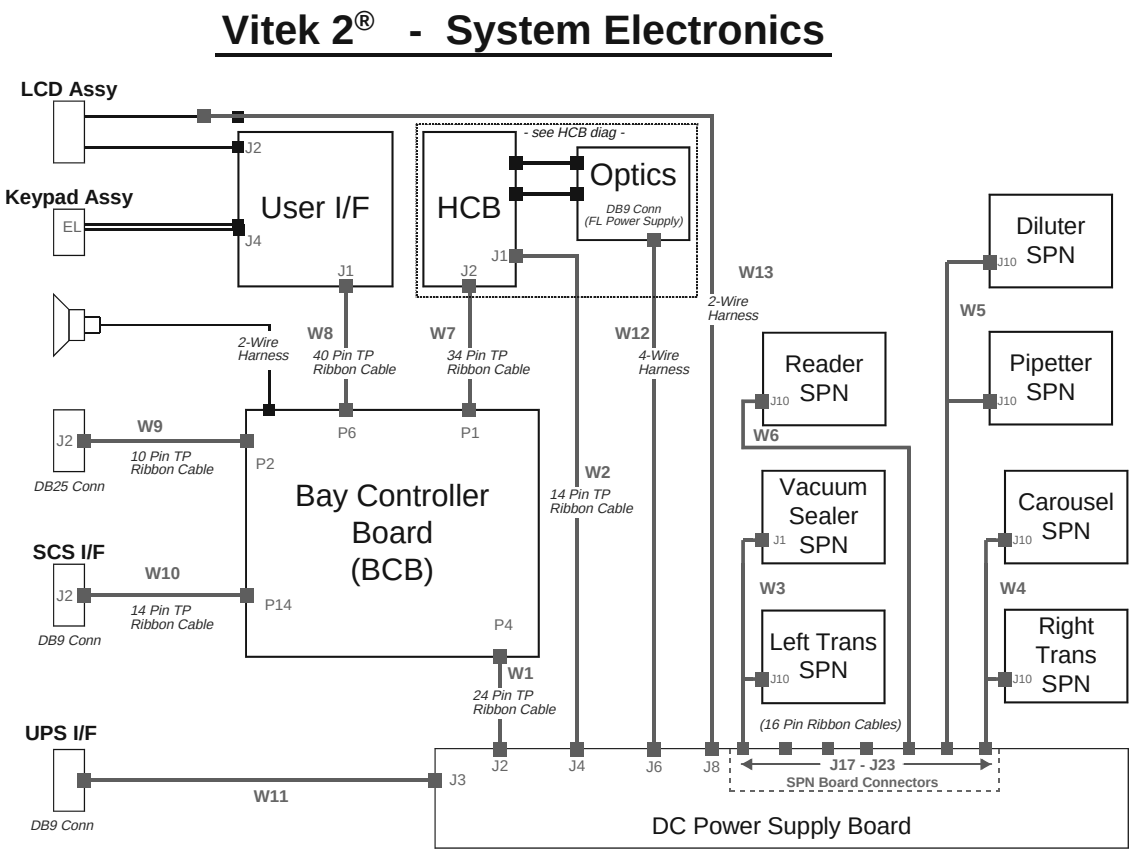


Figure B-3a ***VITEK•2®*** System Electronics and BCB Connections

Vitek 2®XL - System Electronics

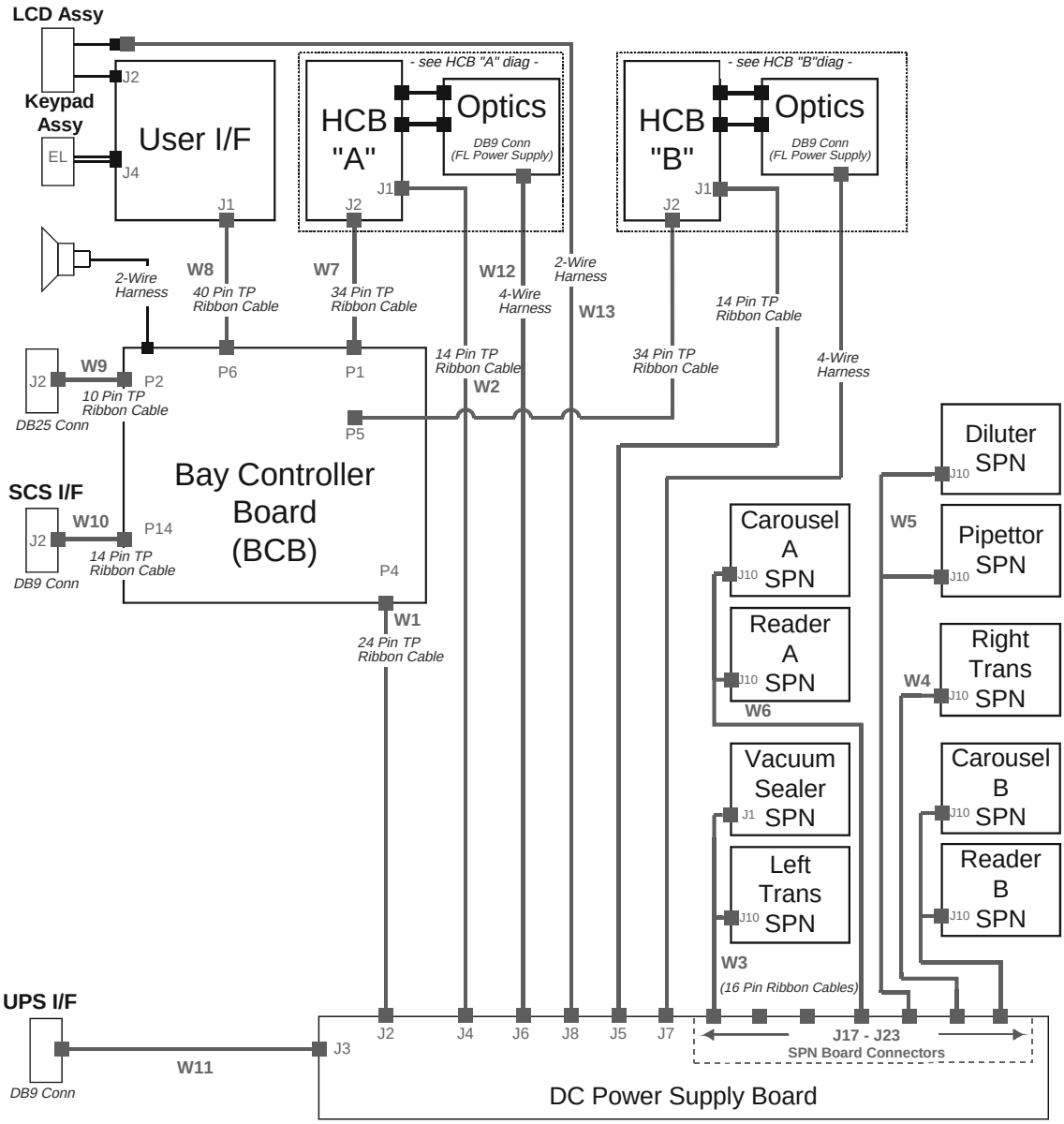


Figure B-3b ***VITEK•2® XL*** System Electronics and BCB Connections

Head Control Board

The Head Control Board (HCB) connected to the BCB provides the local control functions and data sharing for the laser bar code reader, the button memory, and the instrument optics control. Figure B-4a shows the HCB "A" board. Figure B-4b shows the HCB "B" board. Figure B-4c shows an illustration of the HCB.

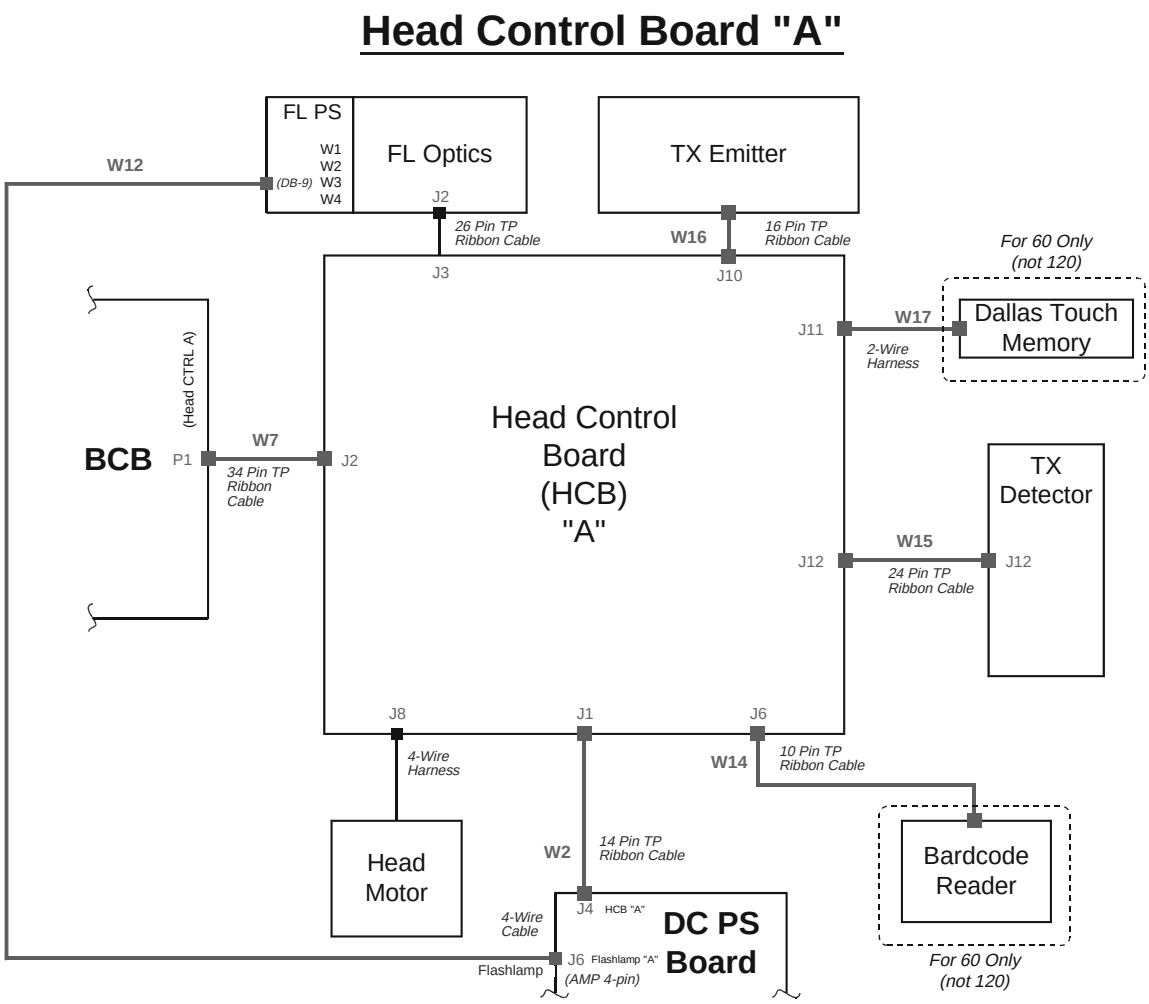


Figure B-4a Head Control Board "A" (60)

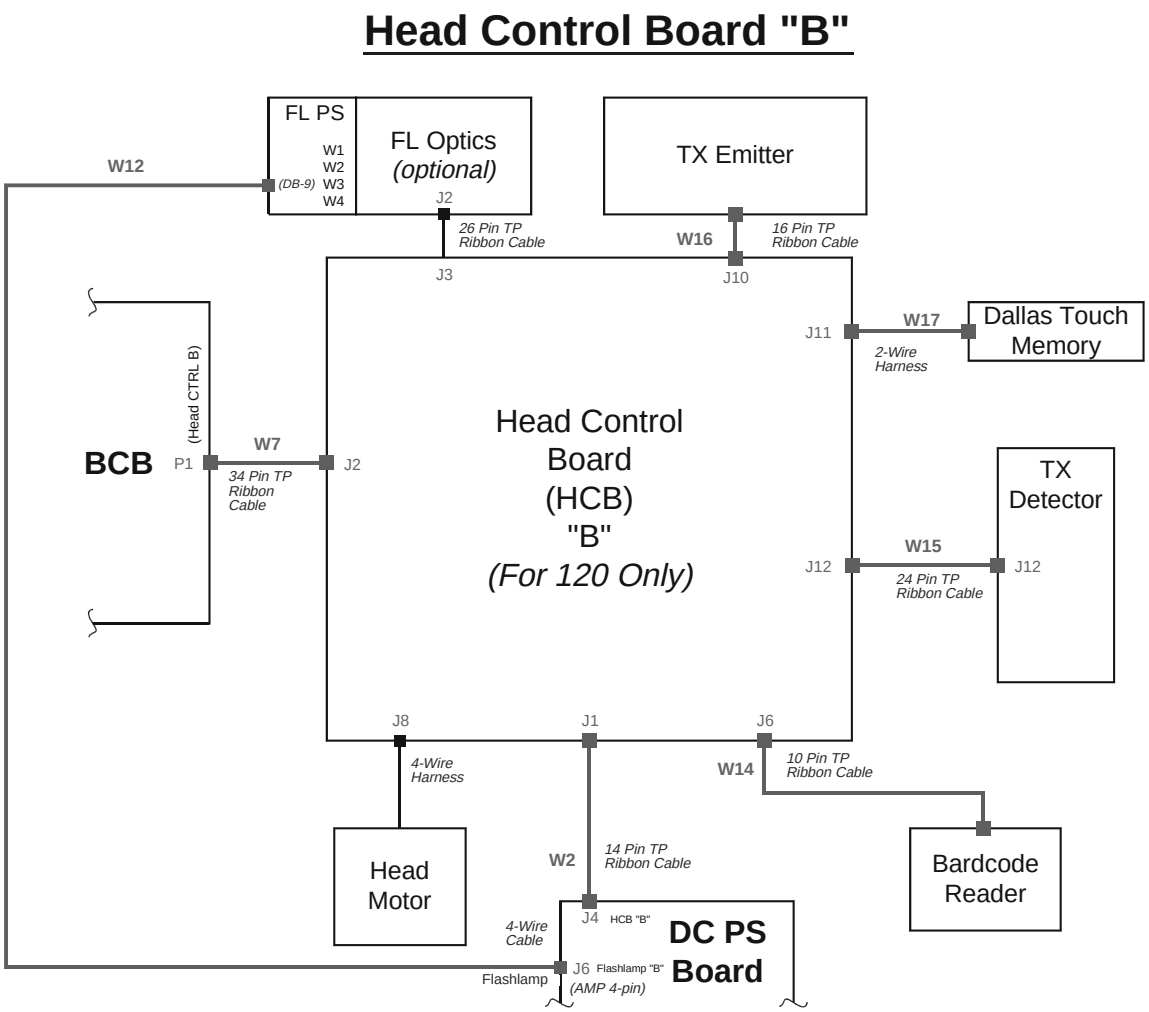


Figure B-4b Head Control Board “B” (120)

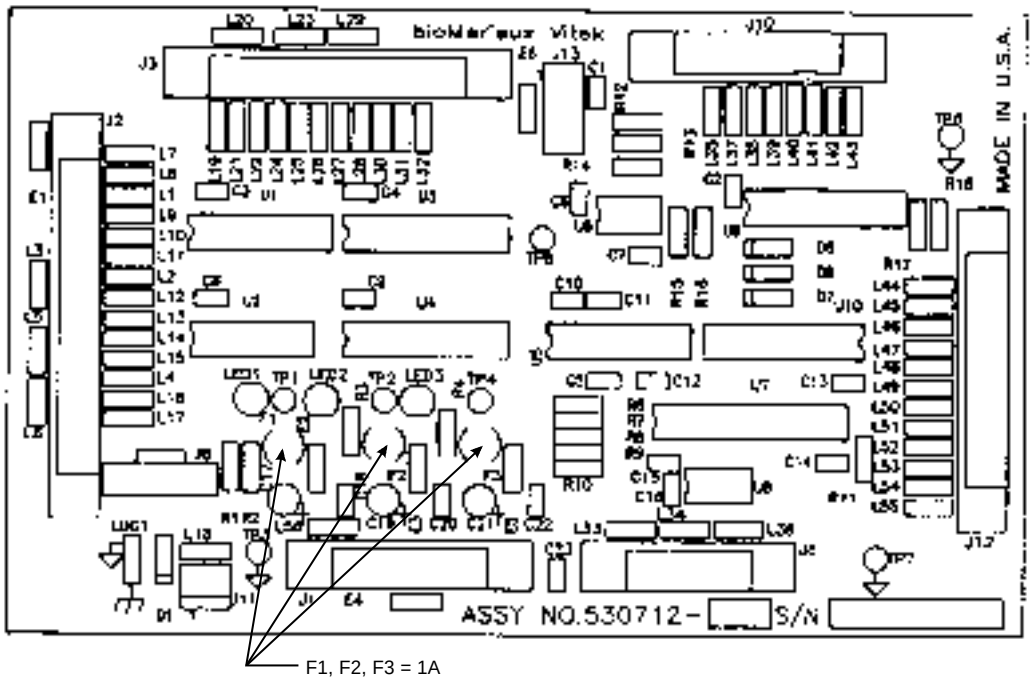
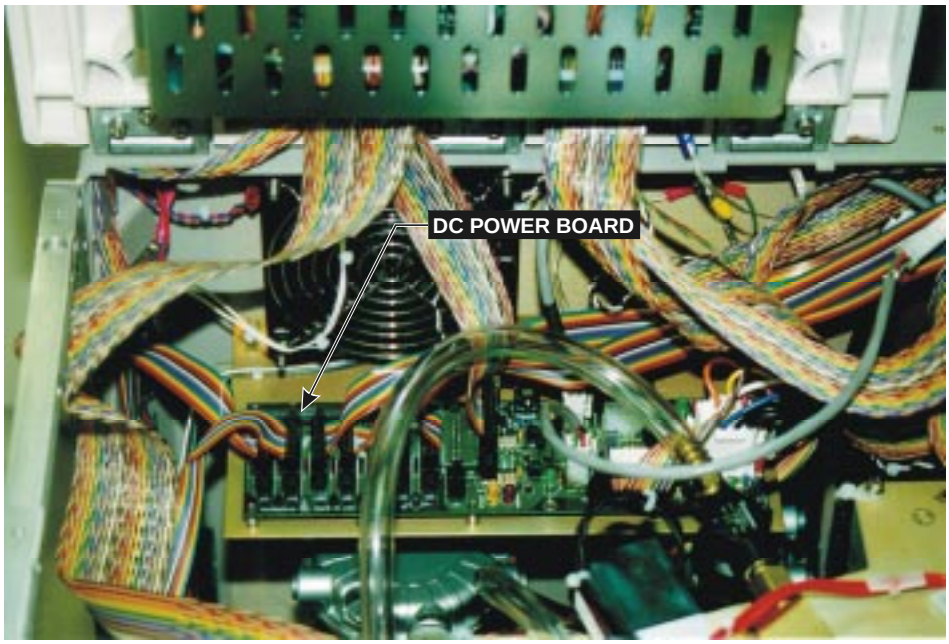


Figure B-4c HCB Board Illustration

DC Power Supply Board

The DC Power Supply Board provides the DC power to the SPN Boards and to the Optics as shown in Figure B-5.



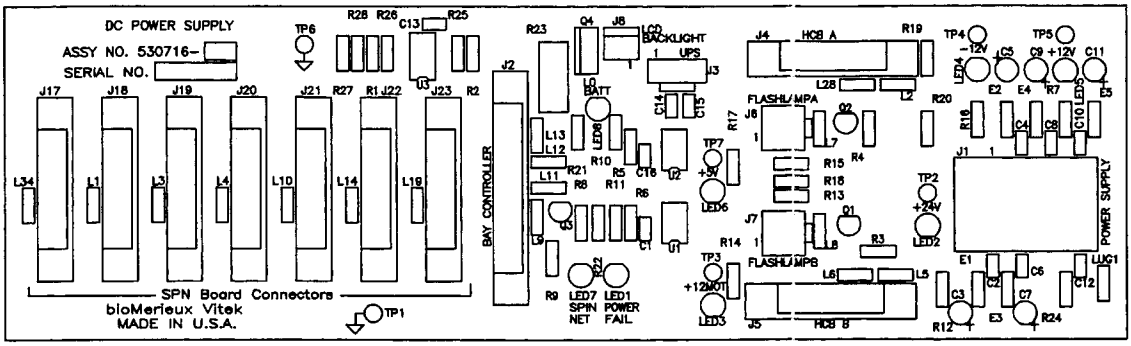


Figure B-5 DC Power Supply Board

Sample Prep Integrated Network Board

The following charts shows the SPN board configuration jumpers to setup specific SPN board operation.

SPN BOARD P/N: 530704-1			
NODE	**INSTALLED JUMPERS**	**JP9 POSITION**	**DESCRIPTION**
1	---	---	<BCB>
2	JP2, JP9	1-2	Left Transport
3	JP3, JP9	1-2	Right Transport
4	JP4, JP9	1-2	Diluter
5	JP5, JP9	2-3	Pipettor
6	---	---	Vacuum / Sealer
7	JP7, JP9	1-2	Reader A
8	JP8, JP9	1-2	Carousel A

SPN BOARD P/N: 530704-2		
NODE	**INSTALLED JUMPERS**	**BOARD FUNCTION**
1	---	<BCB>
2	JP2	Left Transport
3	JP3	Right Transport
4	JP4	Diluter
5	JP5	Pipettor
6	---	Vacuum / Sealer
7	JP7	Reader A
8	JP8	Carousel A

SPN BOARD P/N: 530704-2		
NODE	**INSTALLED JUMPERS**	**BOARD FUNCTION**
1	---	<BCB>
2	JP2	Left Transport
3	JP3	Right Transport
4	JP4	Diluter
5	JP5	Pipettor
6	---	Vacuum / Sealer
7	JP7	Reader A
8	JP8	Carousel A
9	JP1	Reader B
10	JP6	Carousel B

The SPN boards receive power from the DC Power Supply Board mounted on the inside left back plate of the instrument, via connectors and flat ribbon cables. See Figure B-6.

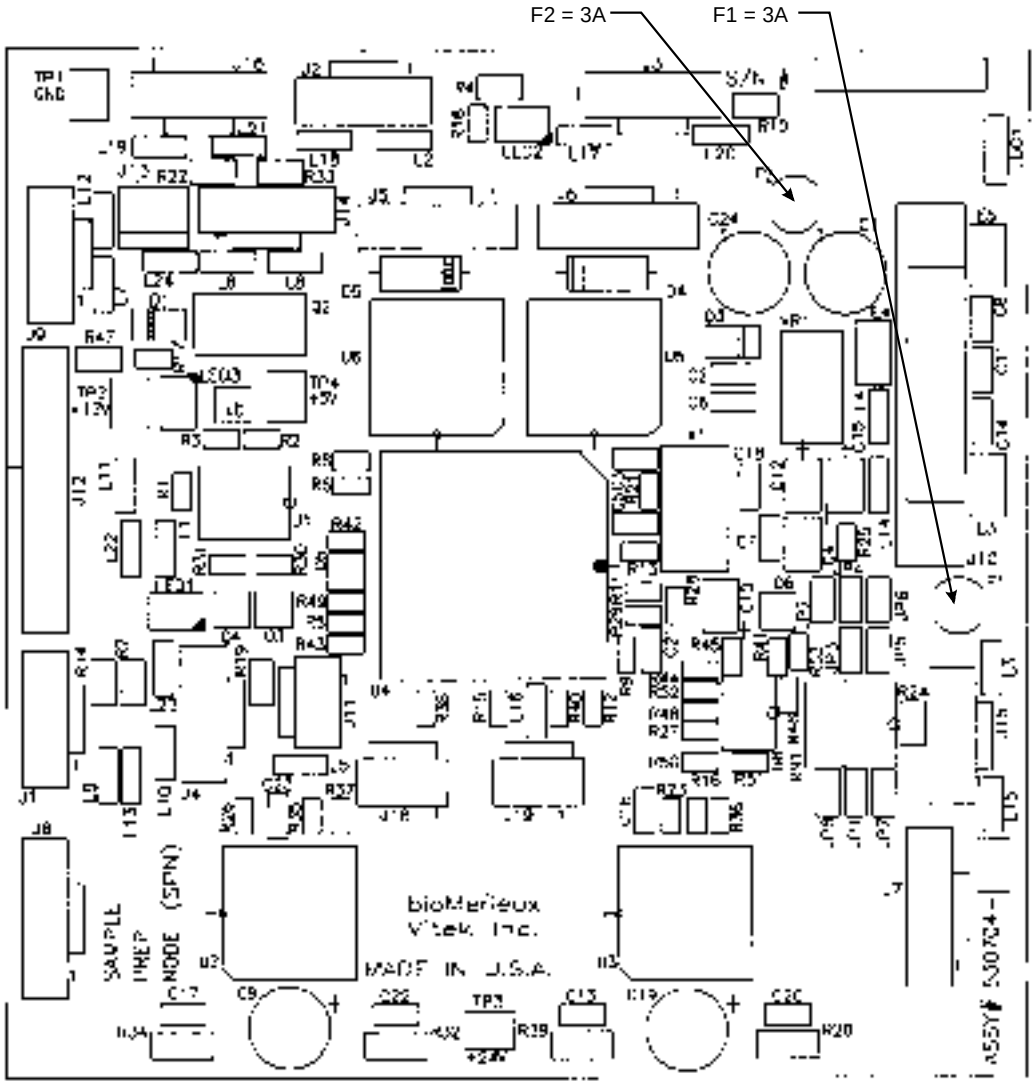


Figure B-6 Sample Prep Node (SPN) Board

Figure B-7 through Figure B-14 shows the various PC board block diagrams of the SPN boards and the major components sensed or controlled by each board.

SPN Board Block Diagram

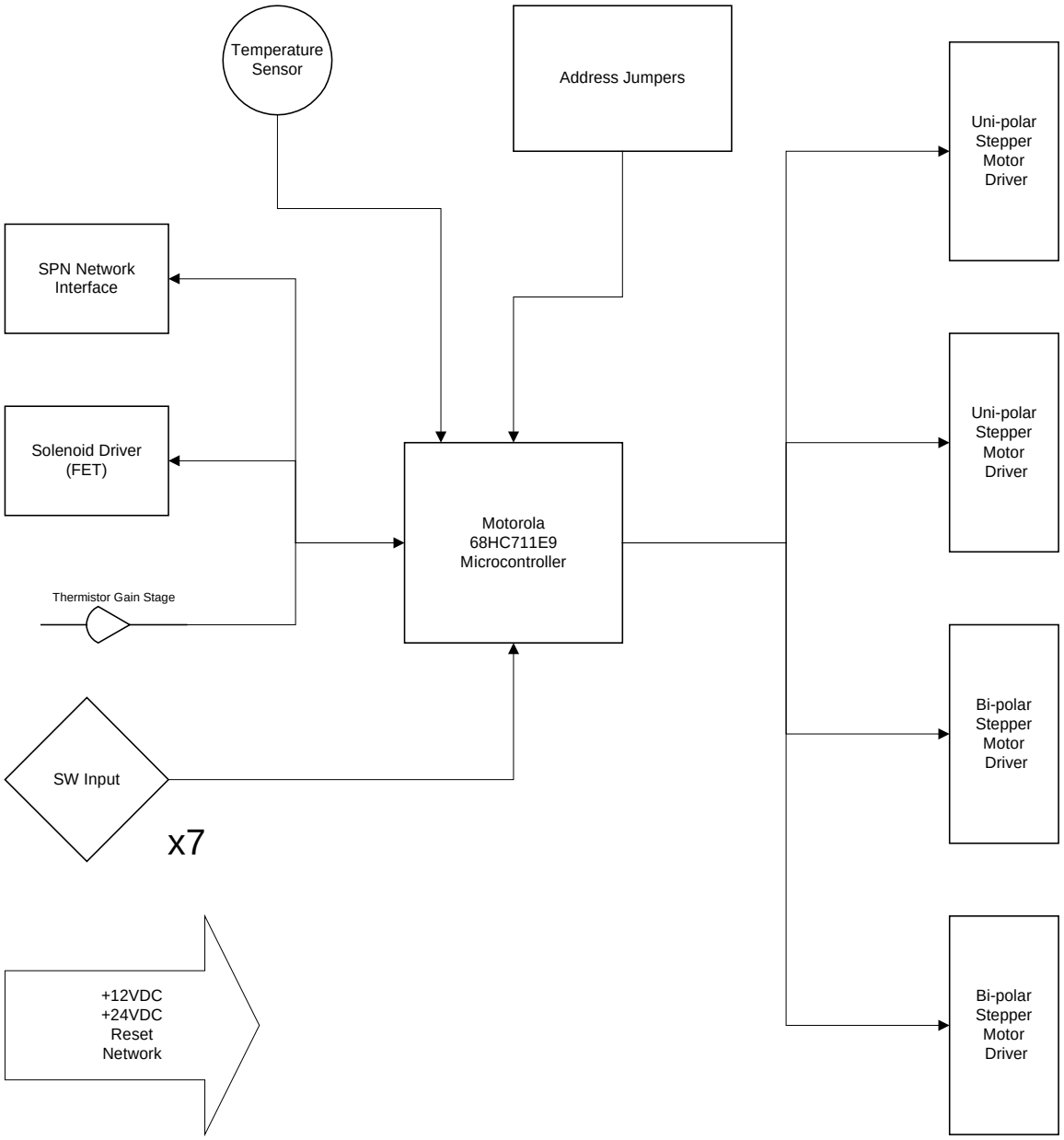


Figure B-7 SPN Board Block Diagram

Left Transport SPN Board

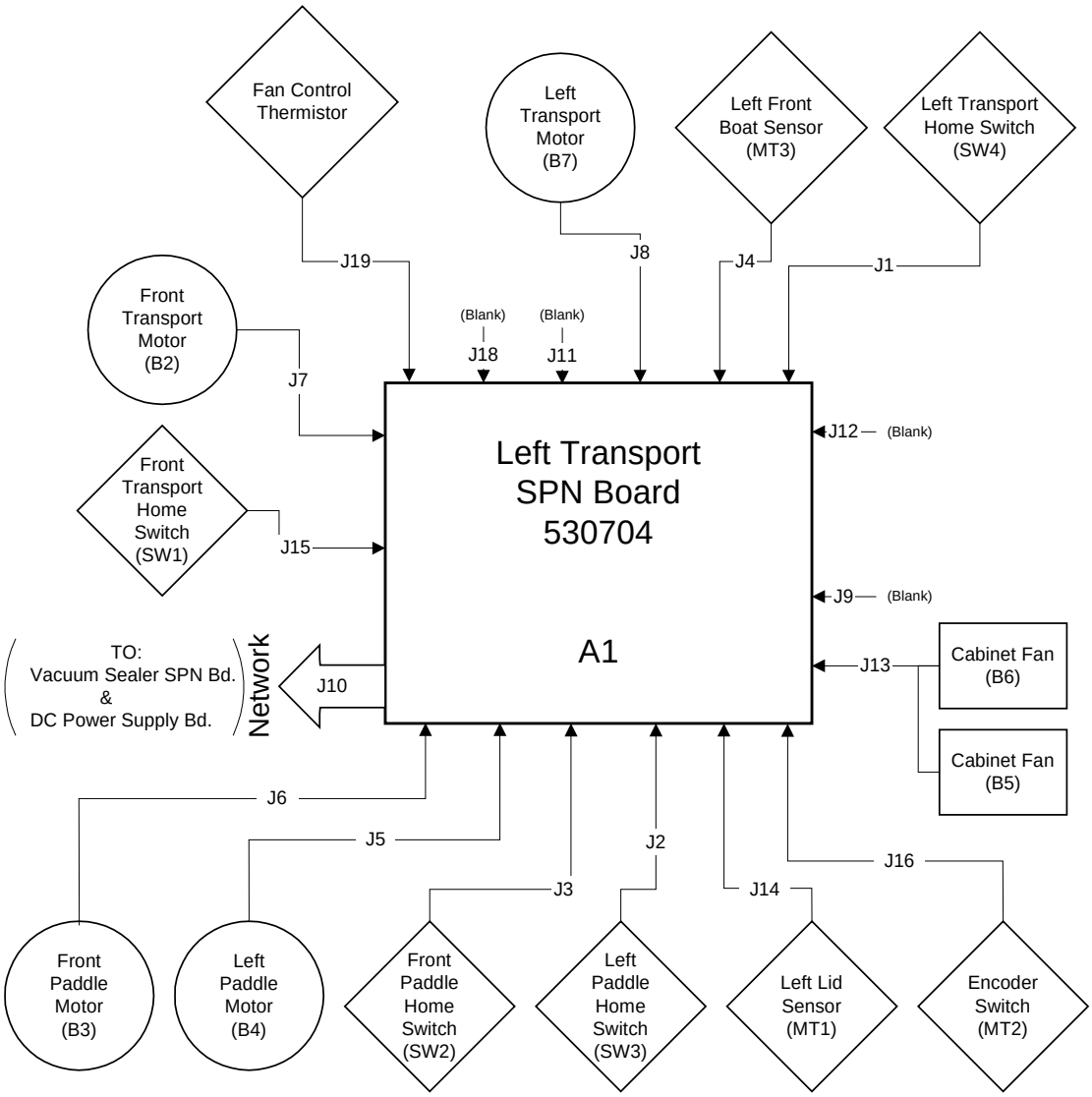


Figure B-8 Left Transport SPN Board

Right Transport SPN Board

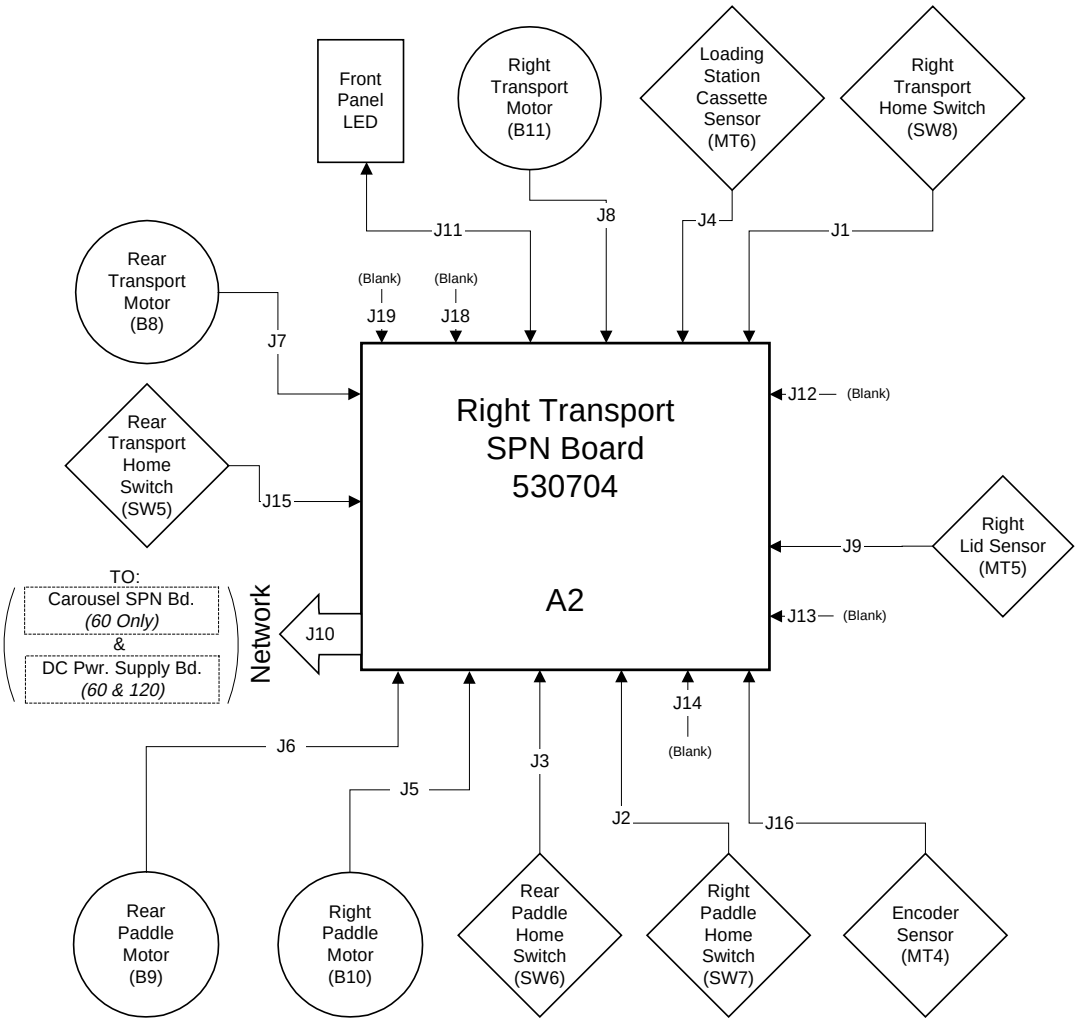


Figure B-9 Right Transport SPN Board

Diluter SPN Board

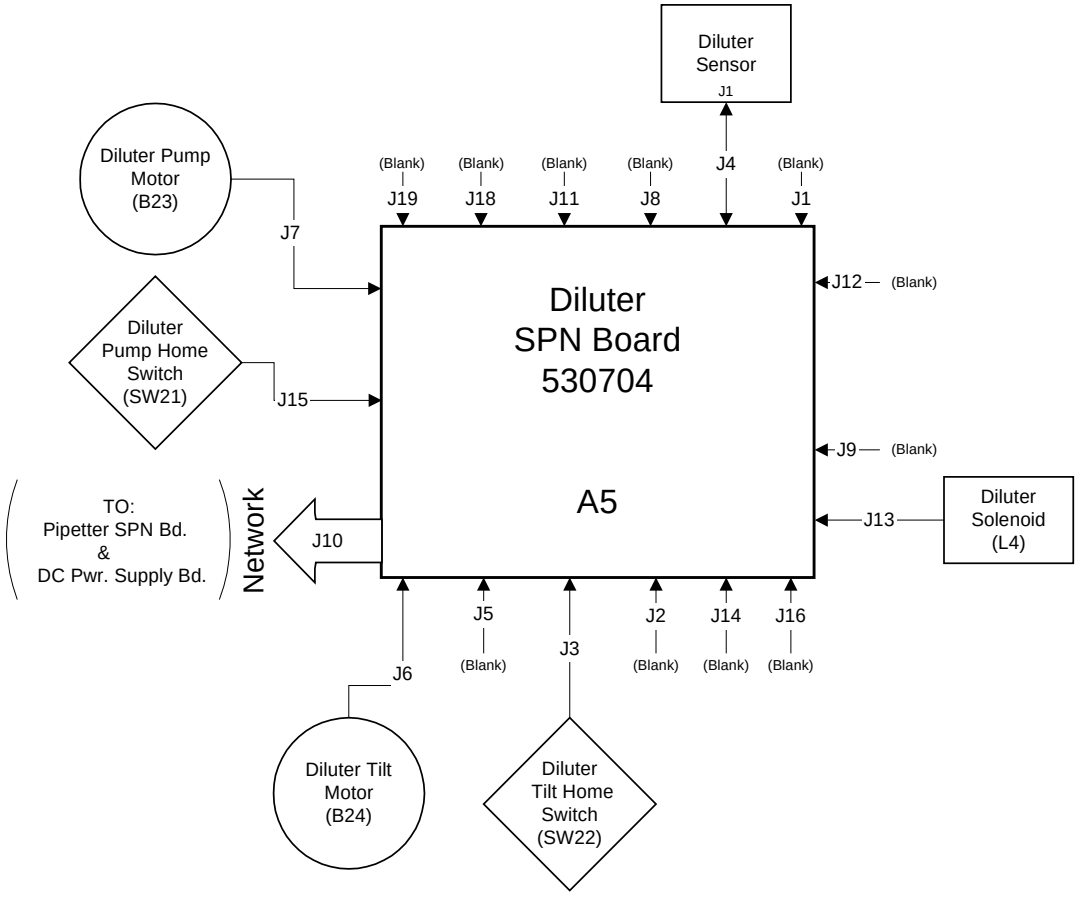


Figure B-10 Diluter SPN Board

Pipettor SPN Board

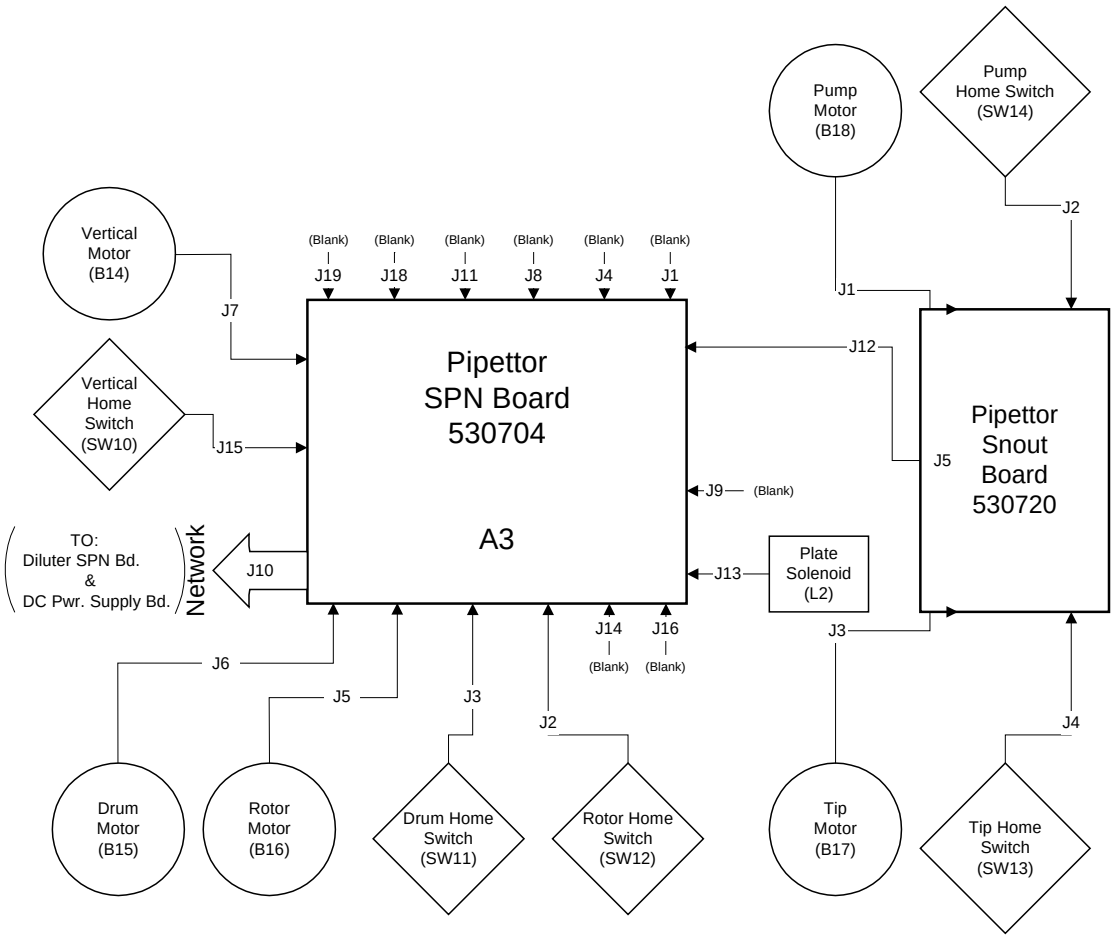


Figure B-11 Pipettor SPN Board

Reader "A" SPN Board

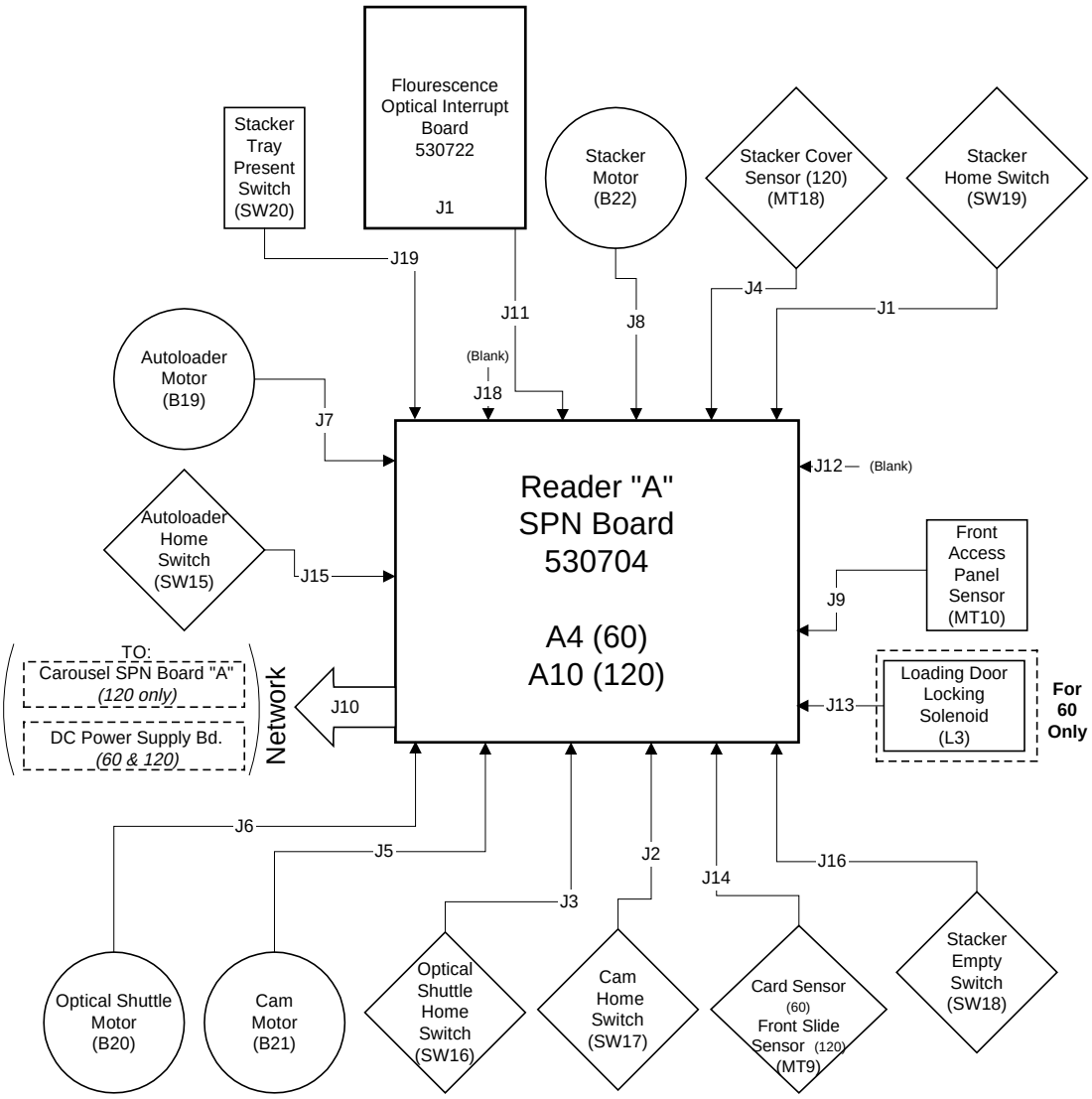


Figure B-12a Reader "A" SPN Board

Reader "B" SPN Board (120 Only)

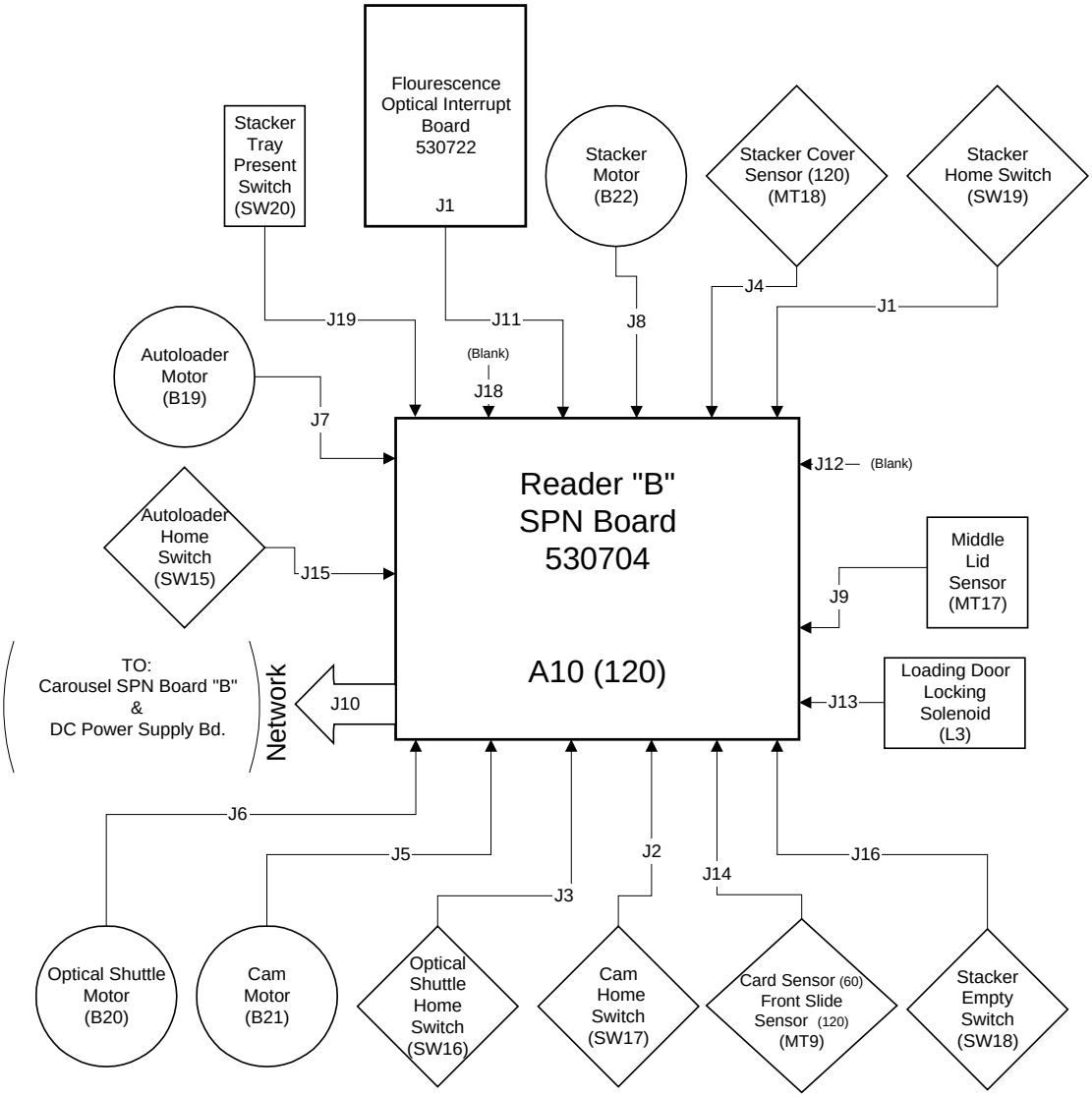


Figure B-12b Reader "B" SPN Board (120 only)

Carousel "A" SPN Board

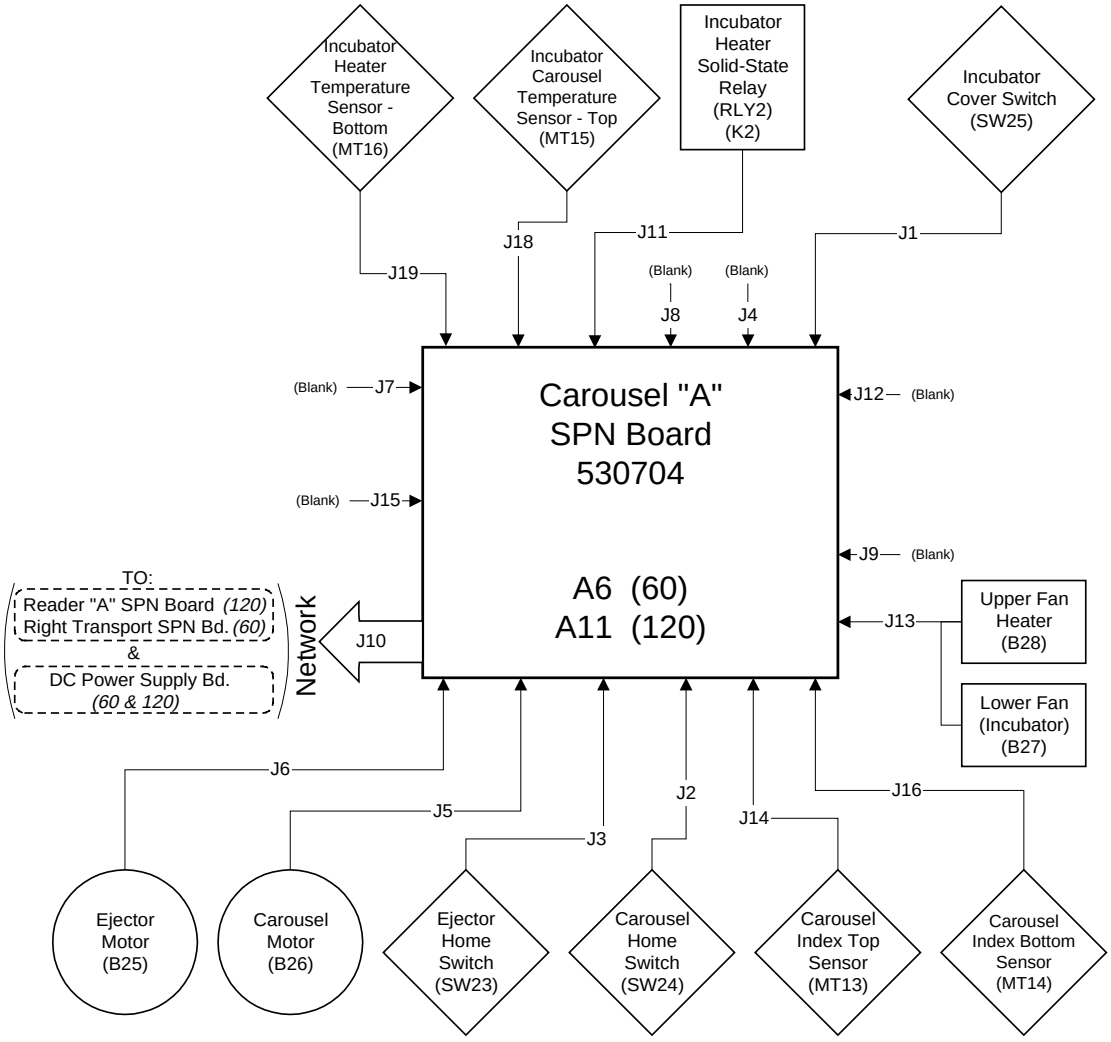


Figure B-13a Carousel "A" SPN Board

Carousel "B" SPN Board (120 Only)

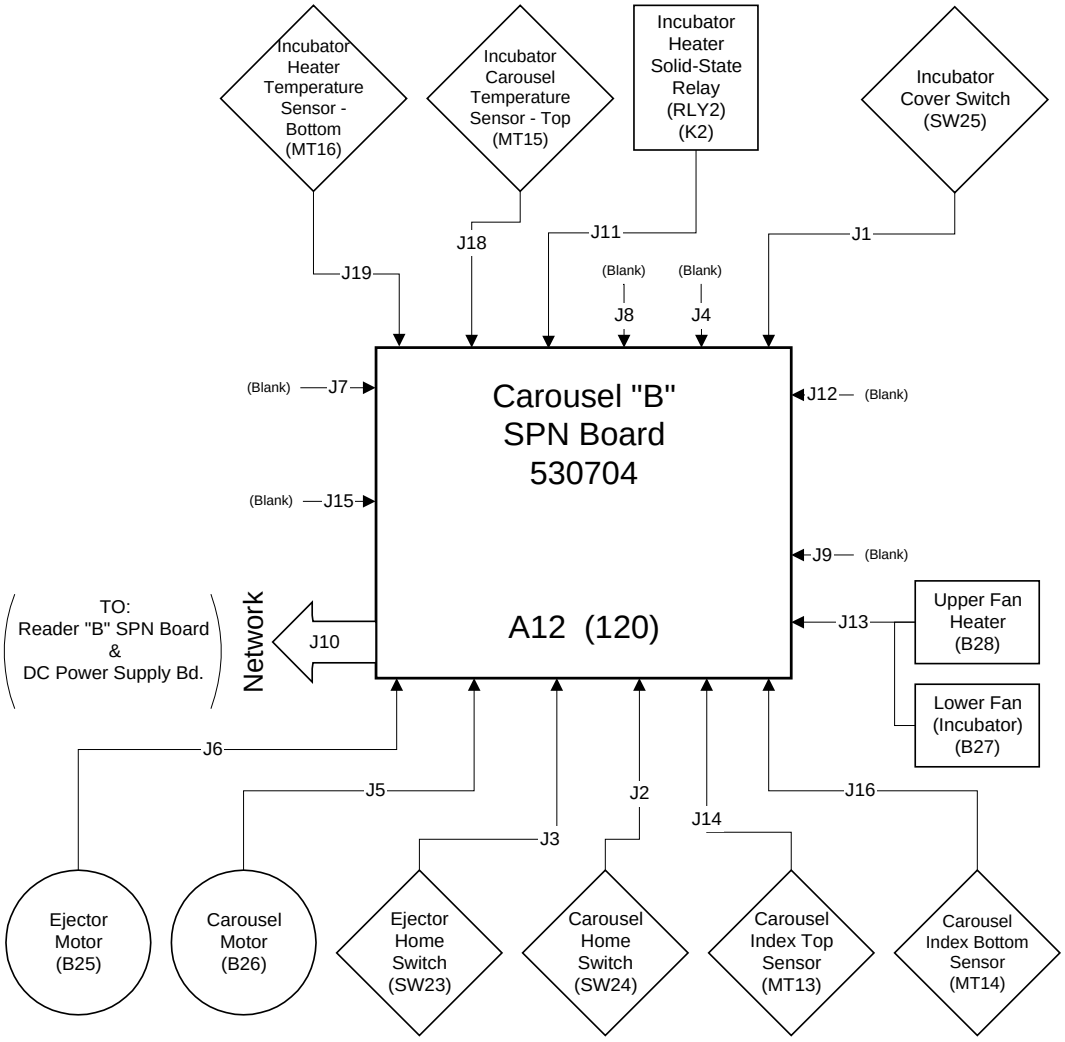


Figure B-13b Carousel "B" SPN Board (120 only)

Vacuum Sealer Board

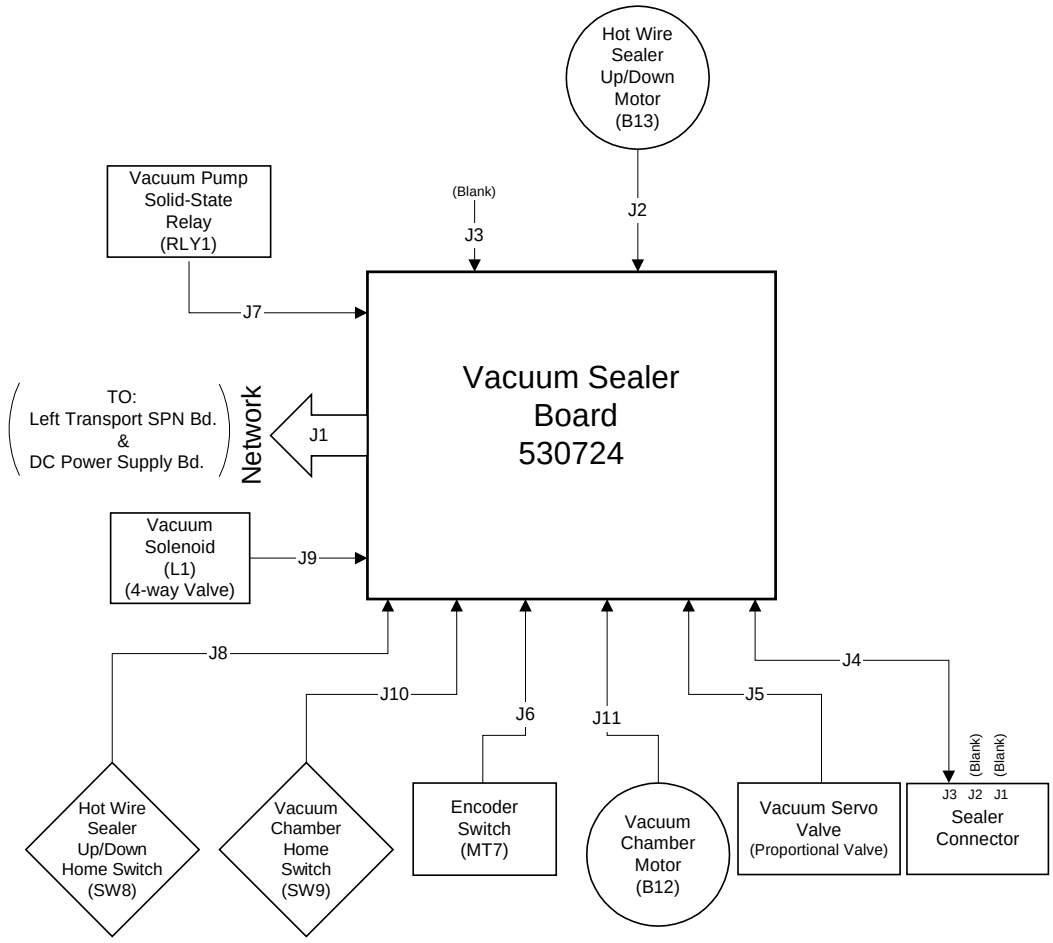


Figure B-14 Vacuum Sealer SPN Board

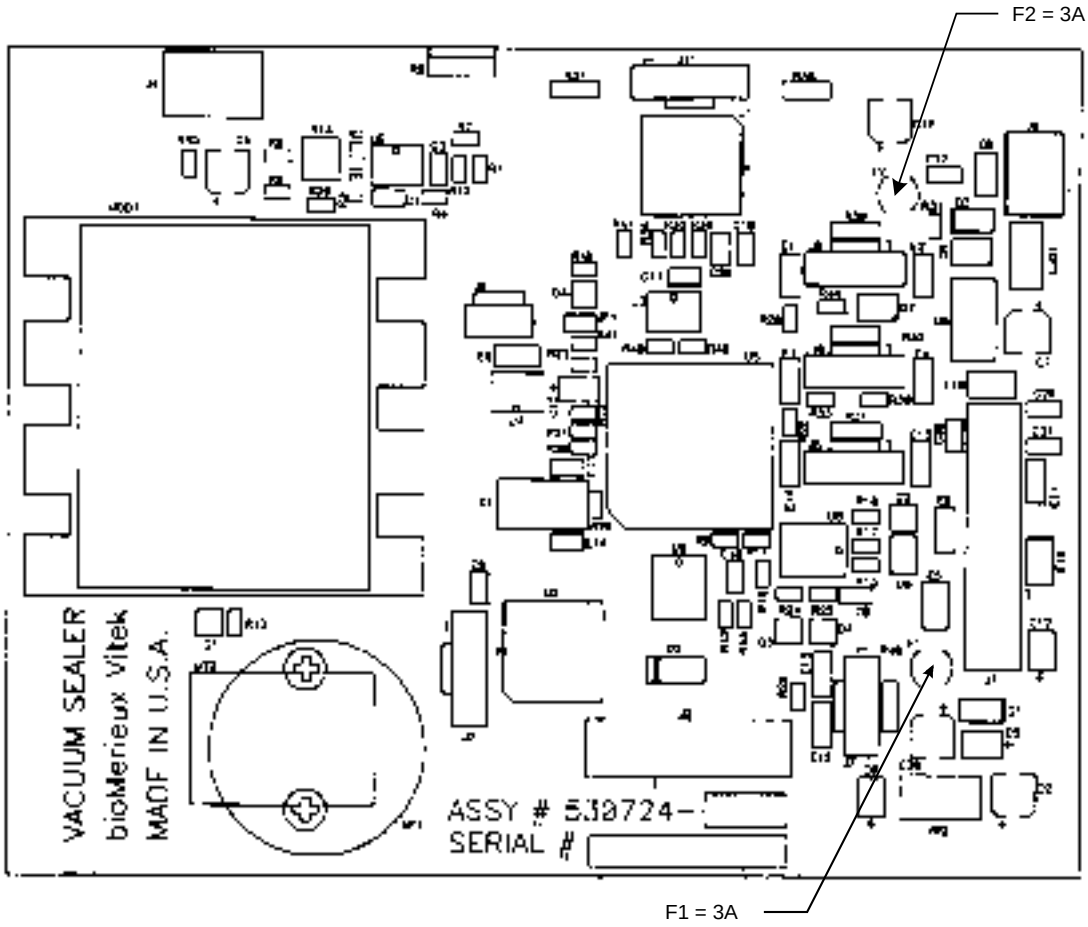


Figure B-15 Vacuum Sealer Board

Sealer Connection Board

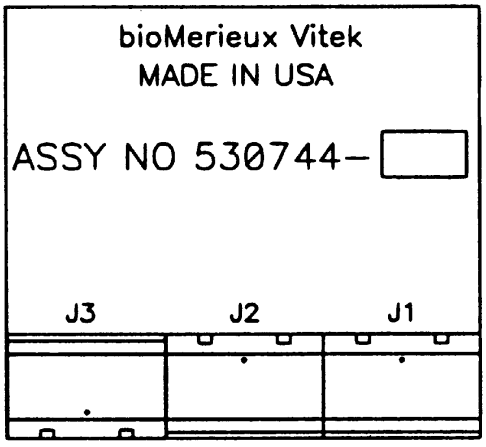


Figure B-16 Sealer Connection Board

User Interface (I/F) Board

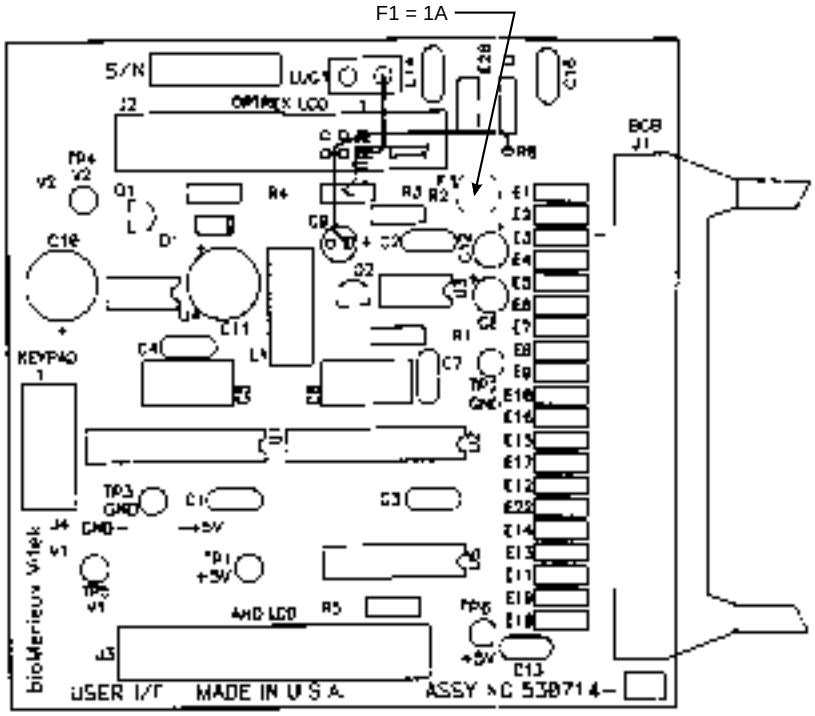


Figure B-17 User Interface (I/F) Board

Bar Code Board

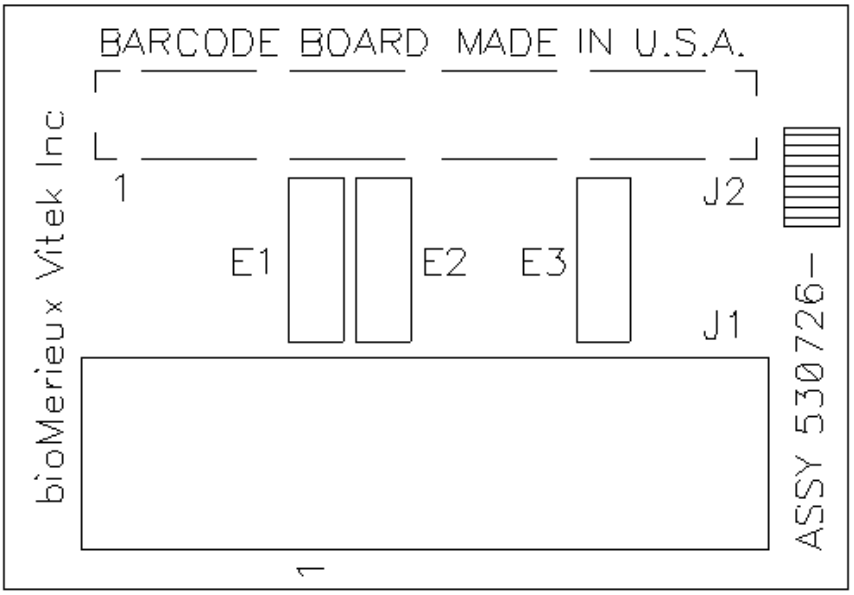


Figure B-18 Bar Code Board

Fluorescence Optical Interrupt Board

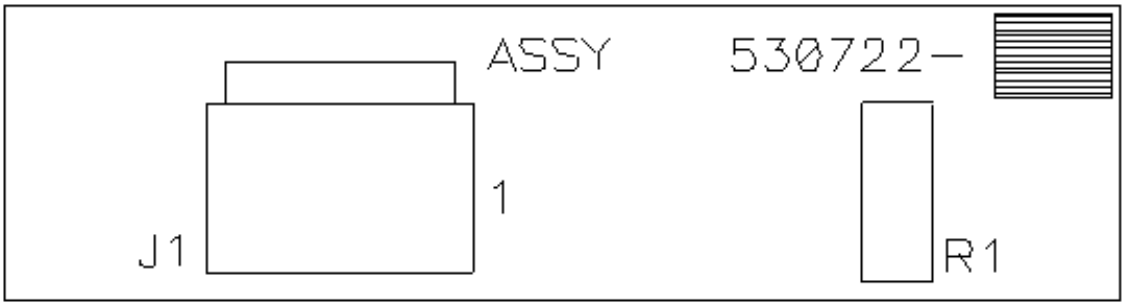


Figure B-19 Fluorescence Optical Interrupt Board

Workstation Connector Board

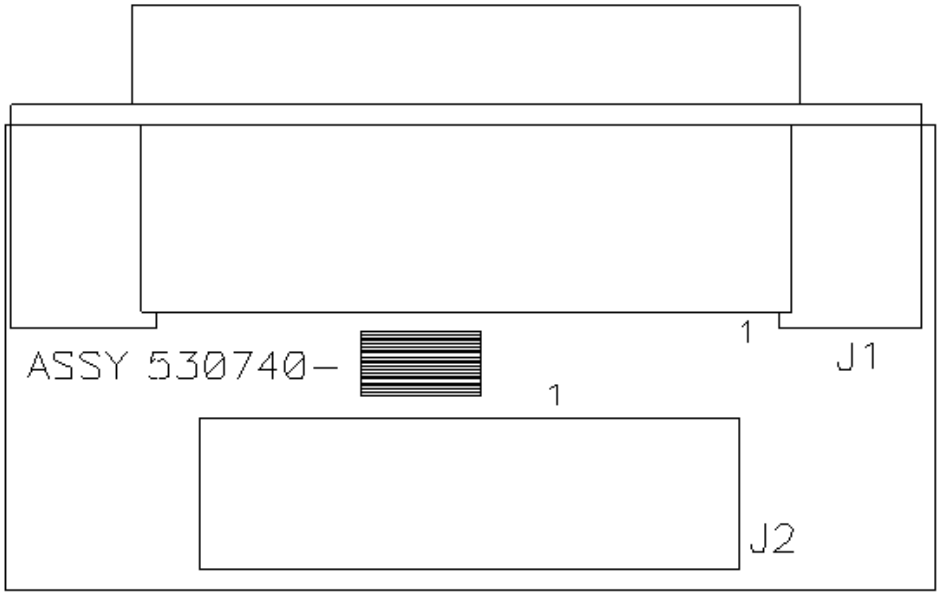


Figure B-20 Workstation Connector Board

Power Supply Cabinet Diagram

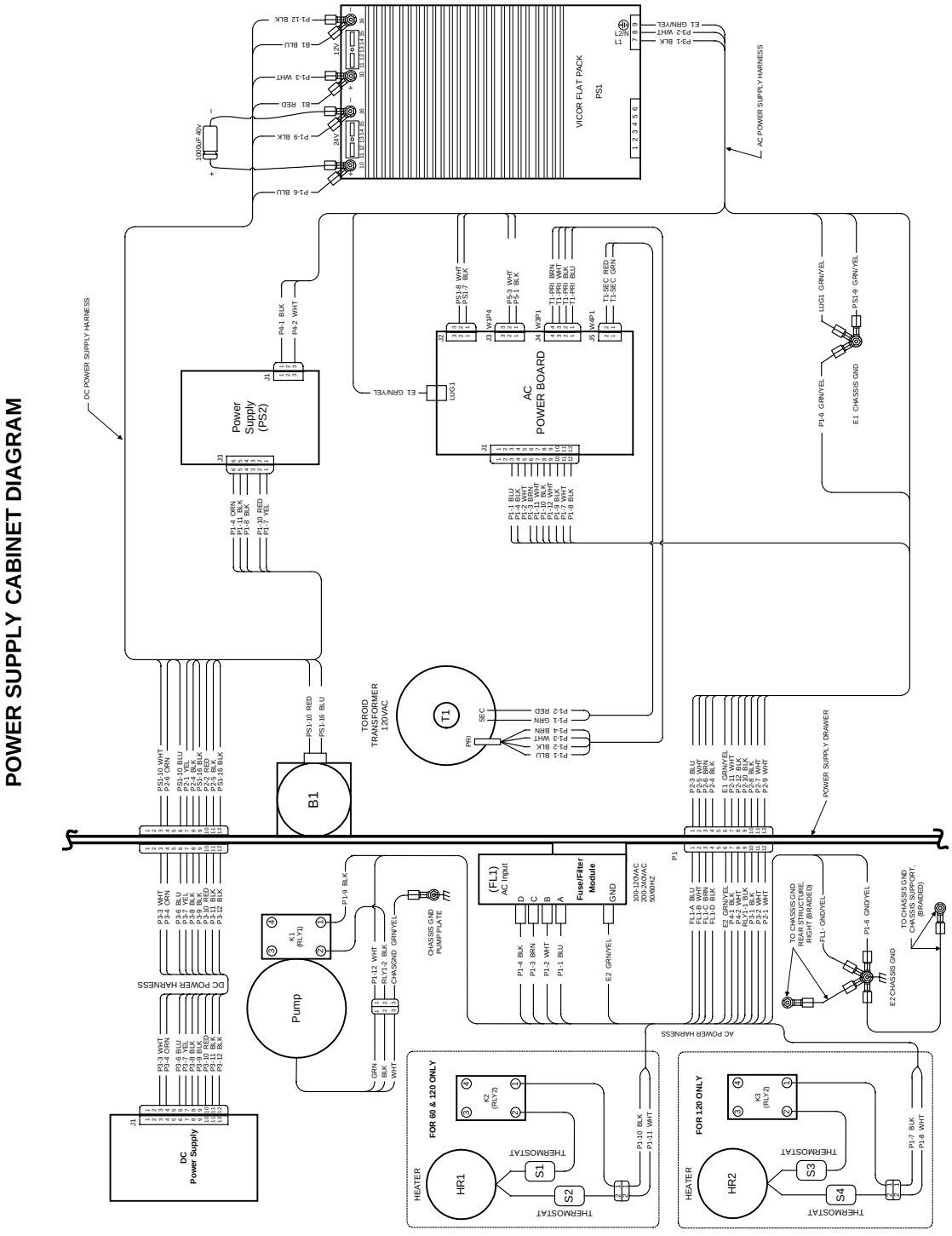


Figure B-21 Power Supply Cabinet Diagram

AC Power Supply Board

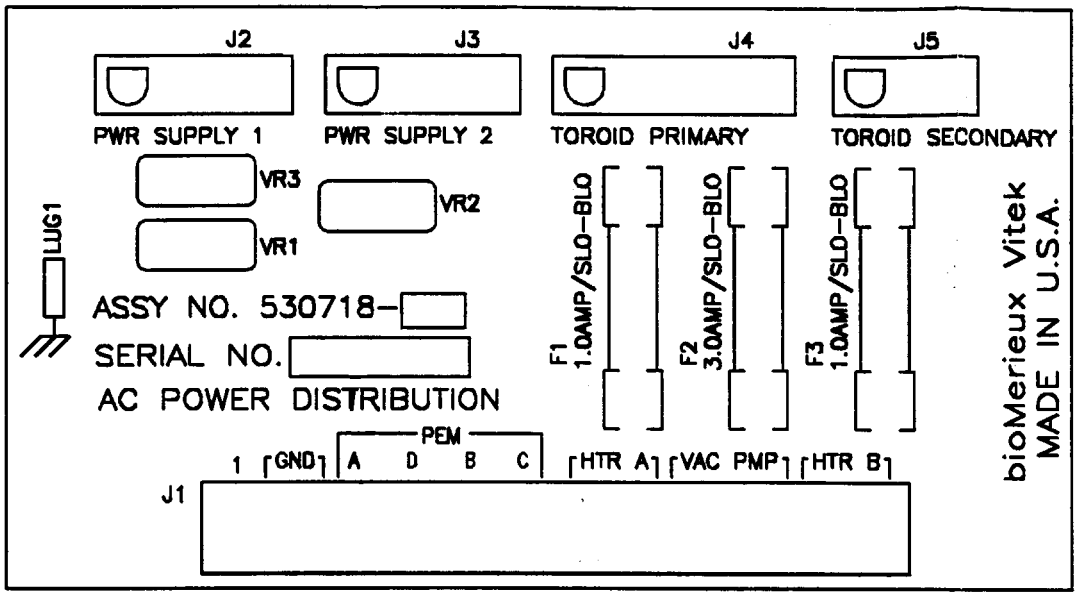


Figure B-22 AC Power Supply Board

TX Optical System - Cross Section

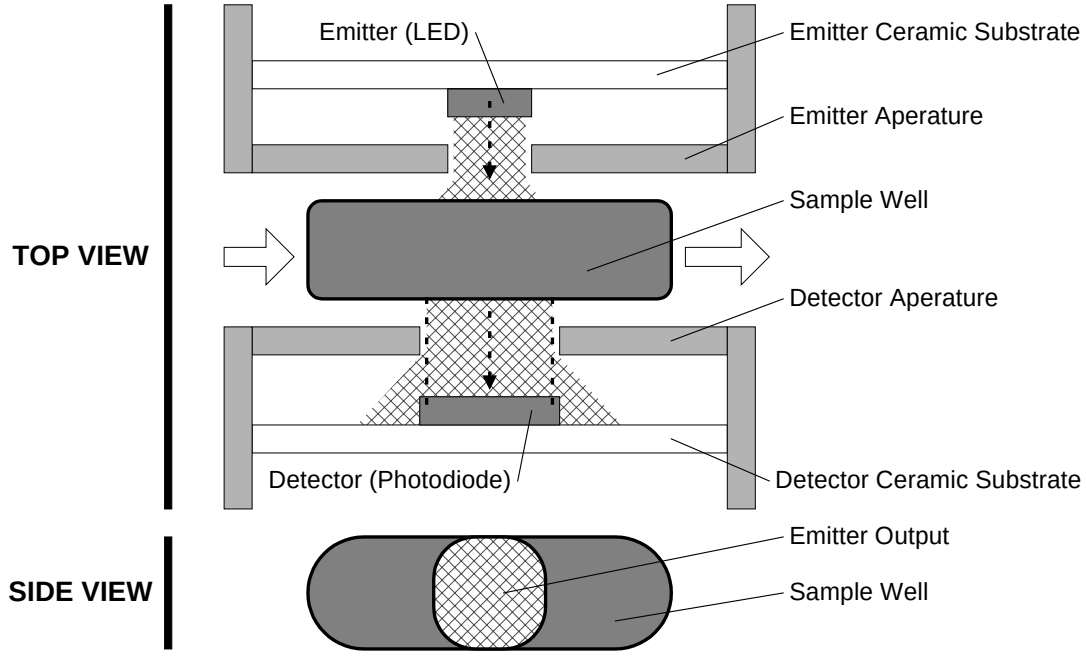


Figure B-23 TX Optical System - Cross Section

FL Optical System - Cross Section

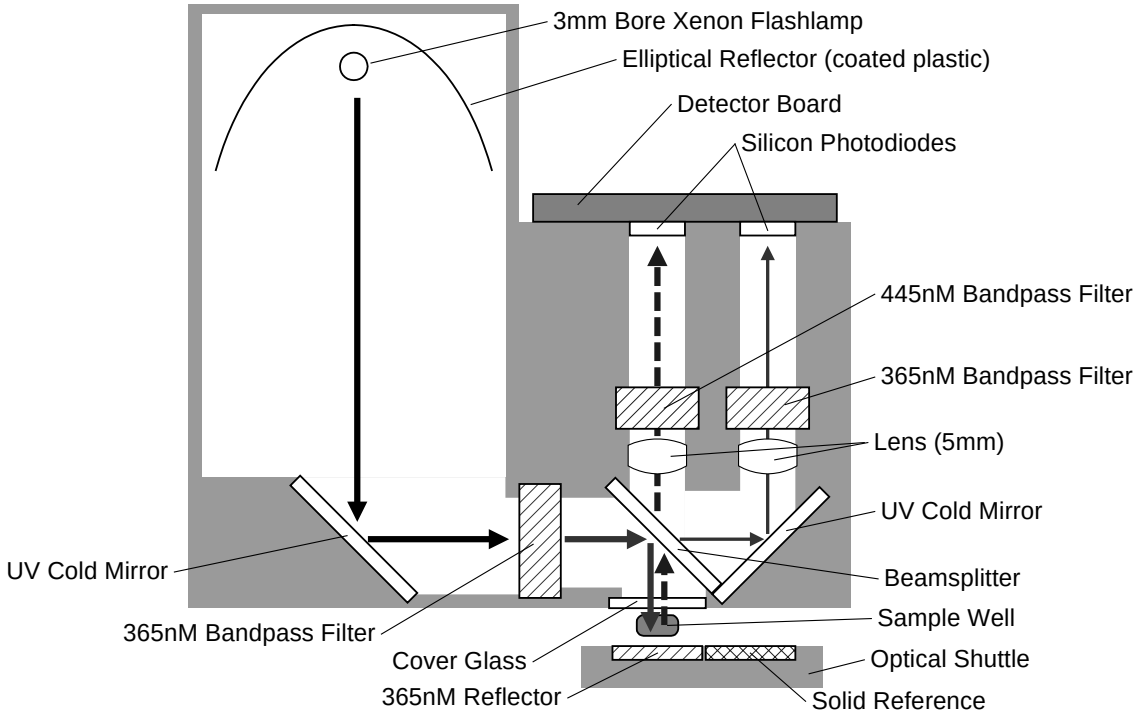


Figure B-24 FL Optical System - Cross Section

Vacuum Chamber Piping Diagram

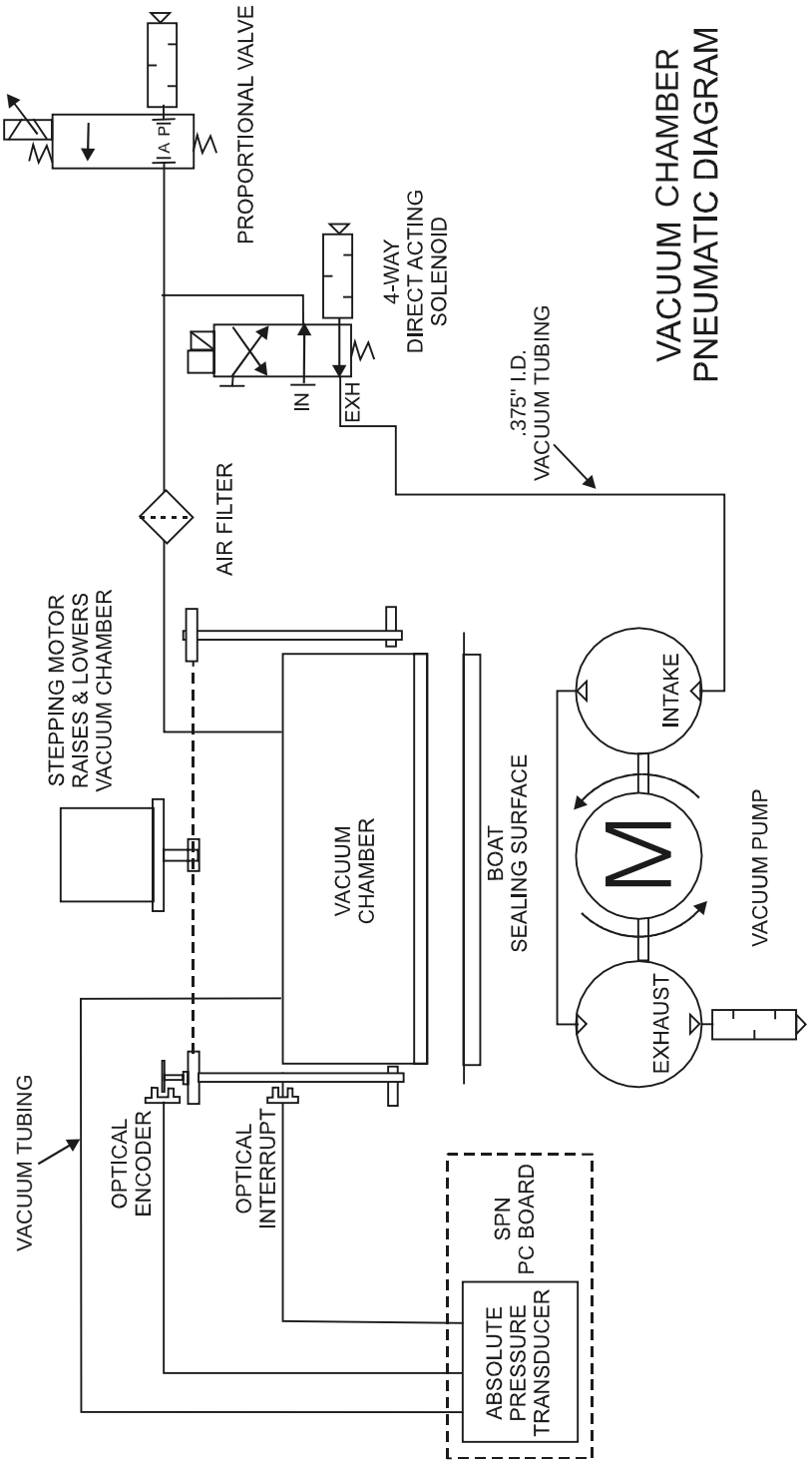


Figure B-25 Vacuum Chamber Piping Diagram

Appendix C: **Glossary**

BCB	Bay Controller Board, the main microprocessor in the instrument.
Boat	See cassette carrier.
Cassette carrier	The tray like device that carries the cassette around the instrument. It forms the bottom half of the vacuum chamber and will help capture any spills. It is removable for cleaning.
Carousel	The rotating incubator section, which holds up to four quads of cards.
Card Sealer	Melts and seals the transfer tube that delivered the inoculum to the card from the test tube using a hot wire.
Cassette	The card and tube carrier that is loaded with sample and up to 15 cards before being inserted into the instrument. It can contain button memory that is used to transfer information from the Smart Carrier Station (SCS) to the instrument.
CPU	Central Processing Unit
Diluter	Dispenses 2.33 ml – 2.63 ml of saline Diluent into a empty susceptibility tube. This system includes a saline dispensing system, 1,000 ml bag of sterile saline and a "fixed volume" dispensing chamber (Dispensing Tube).
Dispenser Tube	A "fixed volume" chamber used to measure and dispense 2.5 mL of saline into a susceptibility tube.
Fluorescence Optics	The optical detection system designed for use with fluorescence substrates with nominal excitations @ 365 nM and emissions @ 445 nM.
Growth Wells	The pockets in the cards which are filled with the prepared sample (and which have previously been filled with a test antibiotic or growth media).
GUI	Graphical User Interface
Incubator	The incubator contains a heater and a circulating fan used to incubate the cards during test. The temperature is monitored and controlled through the use of two remote precision thermistors monitored by an microprocessor holding the card at an average temperature within $35.5 \pm 1°C$.
LED	Light Emitting Diode
Non-Volatile	Memory location that does not rely on external power to maintain information.

Optics Head	The physical mount for the optical sensors and transport system to move the cards through the optics.
PCB	Printed Circuit Board
Pipettor	Transfers and mixes the appropriate inoculum volume pre-determined by the card bar-code (60 µl to 300 µl) to adjacent susceptibility tubes. The system includes a drum for pipette tips, a displacement pump, various tip mechanisms.
Quad, Quadrant	A segment of the carrousel that holds 15 cards and is removable for cleaning.
RFI	Radio Frequency Interference
Smart Carrier Station (SCS)	A laptop computer like device used to aid in setting up the test and for entering test information.
Transmittance Optics	A combination of light emitting diodes (emitters) and photodiodes (receivers) used to read the growth results in the card wells.
Transport System	The transport system moves the cassette carriers by pulling them through each process station within the instrument.
Stacker	The mechanism that pushes the cards into the waste tray.
User Interface (UIF) (Display Assembly)	The keypad and screen located on the front of the ***VITEK•2®***. Used to send you messages about operation, on-board consumables, and possible problems and let you control the instrument.
Vacuum System	Fills the card with an inoculum using vacuum displacement principles similar to those used in the bioMérieux Vitek System.
Waste Station	Once testing is complete, cards are stacked in a tray for disposal.
Workstation Computer	The workstation computer is the central diagnostic station connected to the instrument via an RS232 cable.

Appendix D: **Error Code Text**

#	ALARM MESSAGE (MAJOR)	ALARM MESSAGE (MINOR)	DESCRIPTION OF ERROR / SOURCE OF ERROR
1	NA	NA	Currently available for use.
2	Processing Errors	Card Transport System Failure	Boat management and the transport system failed. The instruments transport system is currently halted.
3	Processing Warnings	Cassette loading door is open	When a boat is ready to advance from the cassette loading station, the load door must be closed. A warning will be generated if the boat is ready to advance and the load door is open for more that 1 minute.
4	Hardware Errors	Internal Clock	The RTC(Real Time Clock) hardware on the BCB is running fast or slow.
5	Processing Errors	Vacuum System Failure	The vacuum/sealer SPN board has failed to perform a vacuum cycle during cassette processing.
6	Processing Errors	Card Sealer Failure	The vacuum/sealer SPN board has failed to execute a sealer on command during cassette processing.
7	Processing Errors	Load Failure	Boat management has failed to load cards into the incubator. Generic load failure message.
8	Initialization Errors	Pipettor Failure	The pipettor has failed initialization during system boot.
9	Initialization Errors	Dispenser Failure	The diluter has failed initialization during system boot.
10	Processing Errors	Dispenser Failure	Failed diluter check while filling and dispensing saline. (Other related error messages may occur.)
11	Initialization Error	Vacuum System Failure	The vacuum system has failed initialization during system boot.
12	Initialization Error	Card Sealer Failure	The sealer system has failed initialization during system boot.
13	Initialization Error	Card Transport System Failure	1 of the 4 paddle-transport systems has failed initialization during system boot.
14	Initialization Error	Card Transport System Failure	1 of the 4 paddle-transport systems has failed initial position forecast during system boot.
15	Hardware Error	Internal Clock	The critical system clock used to time stamp all card reading data points was a negative number during power up.
16	Processing Error	Dispenser Failure	When a cassette is loaded and it will require use of the diluter, a check is performed to verify the presents of a shot-tube. If the shot-tube is not detected, this error message will be generated.
17	Processing Error	Dispenser Failure	During pipettor/diluter processing, if the diluter SPN board fails the diluter fill command and no retries can be made, the card will be terminated and an error message will be generated.

continued…

#	ALARM MESSAGE (MAJOR)	ALARM MESSAGE (MINOR)	DESCRIPTION OF ERROR / SOURCE OF ERROR
18	Processing Error	Pipettor Failure	During pipettor/diluter processing, if the pipettor SPN board fails the pipettor prep command, up to 5 retries attempts will be made to prep the system. If the retries fail to prep the system an error message will be generated.
19	Processing Error	Dispenser Failure	The diluter SPN board has failed to execute diluter empty command during cassette processing.
20	Processing Error	Pipettor Failure	The pipettor SPN board has failed to execute pipettor get command during cassette processing.
21	Processing Error	Pipettor Failure	The pipettor SPN board has failed to execute pipettor put command during cassette processing.
22	Processing Warnings	Stacker tray can not hold the number of cards currently in the Carousel	SEQ: The stacker try can not hold the number of card that are currently in the carousel.
23	Processing Errors	Reader Error Occurred	Cam Error: Card is still under the cam.
24	Processing Errors	General Failure	Cam Error: Max retries on cam.
25	Host Communication Errors	Communication Failure	Host Communications: Only 40% of heap remains, should be host error.
26	Host Communication Errors	Communication Failure	DATATASK: Could not find any more data that had not been sent. Data has been lost. Flash Rollover.
27	Processing Warnings	Tip Level Low	SYS_TASK: Back ground checking thinks the straw level is low.
28	Processing Warnings	Diluent Level Low	SYS_TASK: Back ground checking thinks the diluent level is low.
29	Processing Warnings	Incubator Temperature is HIGH	ENV_TASK: The average incubator temperature is high.
30	Processing Warnings	Incubator Temperature is LOW	ENV_TASK: The average incubator temperature is low.
31	Optical Error	Fluorescence Calibration Failure	FLR-Cal: Optical Shuttle failed to home.
32	Optical Error	Fluorescence Calibration Failure	FLR-Cal: The Offset Calibration Failed.
33	Optical Error	Fluorescence Calibration Failure	FLR-Cal: Optical Shuttle failed to extend.
34	Optical Error	Fluorescence Calibration Failure	FLR-Cal: Optical Shuttle failed to home after the finger print.
35	Hardware Errors	Incubator Temperature Controller Failure	ENV TASK: Head A incubator state has a failure condition.
36	Optical Error	Fluorescence Calibration Failure	FLR-Val: Optical Shuttle failed to home before a validation.
37	Optical Error	Fluorescence Calibration Failure	FLR-Val: Reference Channel failed calibration.
38	Optical Error	Fluorescence Calibration Failure	FLR-Val: Offset Calibration failed.
39	Optical Error	Fluorescence Calibration Failure	FLR-Val: Optical Shuttle failed to extend before high end validation.
40	Optical Error	Fluorescence Calibration Failure	FLR-Val: Failed to calibrate to the finger print.
41	Optical Error	Fluorescence Calibration Failure	FLR-Val: Optical Shuttle failed to home after finger print failed.

continued…

#	ALARM MESSAGE (MAJOR)	ALARM MESSAGE (MINOR)	DESCRIPTION OF ERROR / SOURCE OF ERROR
42	Optical Error	Fluorescence Calibration Failure	FLR-Val: Optical Shuttle failed to home after finger print.
43	Optical Error	Fluorescence Calibration Failure	FLR-Init: Optical Shuttle failed initialization.
44	Processing Error	Load Failure	Fatal error when loading cards into the reader via the read head with DML.
45	Processing Errors	Unload Failure	SEQ: If unloading a card and "verify head is clear" fails and we can not find the card.
46	Processing Errors	Unload Failure	SEQ: Unloading a card and could find that card to unload.
47	Processing Errors	Unload Failure	SEQ: Max retries on the Stacker while unloading a card.
48	Processing Errors	General Failure	SEQ: Recovering from a Fluorescence Card jam failure.
49	Processing Errors	Unload Failure	SEQ: Failure to unload a Fluorescence Card during a jam.
50	Processing Errors	Reader Error Occurred	SEQ: Failure to move a Fluorescence Card during a jam from carousel into the head.
51	Optical Error	Fluorescence Calibration Failure	FLR-Cal: Failure to calibrate the reference channel during liquid calibration.
52	Hardware Errors	Incubator Temperature Controller Failure	ENV TASK: Head B incubator state has a failure condition.
53	Optical Error	Fluorescence Requires Liquid Calibration	FLR-Cal: Failure to calibrate the offset during liquid calibration.
54	Optical Error	Fluorescence Process Failure	SEQ: Could not find the first edge of the card while reading the Fluorescence Card.
55	Processing Errors	Unload Failure	SEQ: Failure to unload card during Fluorescence jam.
56	Processing Warnings	Incubator cover is off	SEQ: We have tried to move the carousel, but the incubator door is open.
57	Processing Errors	Reader Error Occurred	SEQ: Snaking Error.
58	Processing Errors	Reader Error Occurred	SEQ: Max recover attempts during a Cam jam.
59	Processing Errors	Unload Failure	SEQ: Unload failure while attempting to recover from Cam jam.
60	Processing Errors	Unknown Card Type at Slot:	SEQ: Could not find matching wellmap to card before reading card.
61	Host Communication Errors	Communication Failure	SYS: Over 100 ENQs sent with no ACK received.
62	Processing Errors	Reader Error Occurred	SEQ: Could not find Fluorescence card to process. Card could be still in the carousel.
63	Processing Errors	Reader Error Occurred	SEQ: Could not find Transmittance card to process. Card could be still in the carousel.
64	Initialization Errors	Incubator Temperature Controller Failure	SEQ 60: Incubator failed initialization.
65	Initialization Errors	Motor/Sensor Failure	SEQ 60: Ejector failed initialization.
66	Initialization Errors	Motor/Sensor Failure	SEQ 60: Cam failed initialization.
67	Initialization Errors	Motor/Sensor Failure	SEQ 60: Cam failed init cycle.
68	Initialization Errors	Motor/Sensor Failure	SEQ 60: Stacker failed initialization.

continued…

#	ALARM MESSAGE (MAJOR)	ALARM MESSAGE (MINOR)	DESCRIPTION OF ERROR / SOURCE OF ERROR
69	Initialization Errors	Motor/Sensor Failure	SEQ 60: Autoloader failed initialization.
70	Initialization Errors	Motor/Sensor Failure	SEQ 60: Carousel failed initialization.
71	Initialization Errors	Motor/Sensor Failure	SEQ 60: Carousel failed Quad search 1.
72	Initialization Errors	Motor/Sensor Failure	SEQ 60: Carousel failed Quad search 2.
73	Initialization Errors	Motor/Sensor Failure	SEQ 60: Carousel failed Quad search 3.
74	Initialization Errors	Motor/Sensor Failure	SEQ 60: Carousel failed Quad search 4.
75	Initialization Errors	Incubator Temperature Controller Failure	SEQ 120: Incubator failed initialization.
76	Initialization Errors	Motor/Sensor Failure	SEQ 120: Ejector failed initialization.
77	Initialization Errors	Motor/Sensor Failure	SEQ 120: Cam failed initialization.
78	Initialization Errors	Motor/Sensor Failure	SEQ 120: Cam failed init cycle.
79	Initialization Errors	Motor/Sensor Failure	SEQ 120: Stacker failed initialization.
80	Initialization Errors	Motor/Sensor Failure	SEQ 120: Autoloader failed initialization.
81	Initialization Errors	Motor/Sensor Failure	SEQ 120: Carousel failed initialization.
82	Initialization Errors	Motor/Sensor Failure	SEQ 120: Carousel failed Quad search 1.
83	Initialization Errors	Motor/Sensor Failure	SEQ 120: Carousel failed Quad search 2.
84	Initialization Errors	Motor/Sensor Failure	SEQ 120: Carousel failed Quad search 3.
85	Initialization Errors	Motor/Sensor Failure	SEQ 120: Carousel failed Quad search 4.
86	Processing Errors	Card has expired at Slot:	SEQ: After the carousel has been jammed for 24 hours, all cards will be expired.
87	Fatal Errors	Restart System	SEQ: Nested carousel jamware, cant get back out of it.
88	Processing Error	Load Failure	Sequence task will generate this error when a fatal load error occurs when loading cards into the reader via the read head with DML.
89	Processing Error	Load Failure	Boat management signals sequence task to prepare for auto-loading before cards can be loaded into the incubator. If sequence task is unable to prepare to load, this error is generated.
90	Processing Errors	Process Jam	SEQ: Sequence failed to 'process card' for multiple reasons. Top level function.
91	Processing Errors	Unload Failure	SEQ: Sequence failed to 'unload card' for multiple reasons. Top level function.
92	Processing Errors	Carousel Jam	SEQ: Sequence failed to 'index carousel' for multiple reasons. Top level function.
93	Hardware Errors	Serial Number Failure	BOOT Up could not find the touch serial number device.
94	Processing Errors	Additional cards were found with calibration/qc cards	A cassette was loaded with FLR-Cal cards and other types of cards were found in the cassette.
95	Processing Warnings	Diluent has been in use longer than the recommended time	SYS_TASK: The Diluent has expired.
96	Processing Warnings	Tips have been in use longer than the recommended time	SYS_TASK: The Tips has expired.
97	Processing Errors	SCS and Bar Code Reader conflict at Slot:	Get Cassette Info: The SCS BarCode string and card type did not match the Bar Code Reader

continued…

#	ALARM MESSAGE (MAJOR)	ALARM MESSAGE (MINOR)	DESCRIPTION OF ERROR / SOURCE OF ERROR
98	Processing Error	Dispenser Failure	When the diluter system has a pending error condition and a new cassette is loaded into the instrument requiring the use of the diluter, boat management will attempt to clear the pending error by sending a diluter initialization command to the diluter SPN board. An error will be generated if this initialization fails.
99	Processing Errors	Reader Error Occurred	SEQ: Max retries during 'fix tx read jam'
100	Processing Errors	Unload Failure	SEQ: Unload failure while attempting to 'fix tx read jam'
101	Processing Errors	Reader Error Occurred	SEQ: Could not get the card out of the carousel during 'fix tx read jam'
102	Optical Error	Transmittance Process Failure	SEQ: Could not find first edge of card while processing a tx card.
103	Processing Errors	Unload Failure	SEQ: Could not recover from error #102
104	Initialization Errors	Power Fail Recovery Failure	SEQ: Could not recover from a Power Fail.
105	Processing Errors	SCS and Bar Code Reader conflict at Slot:	Get Cassette Info: The BarCode reader and SCS both have Barcode info, but the card type s are different.
106	Hardware Errors	Optical Controller Failure	TX 2 was detected without TX 1.
107	Hardware Errors	Optical Controller Failure	TX 3 was detected without TX 1 and/or TX 2.
108	Hardware Errors	Optical Controller Failure	TX 5 was detected without TX 4.
109	Hardware Errors	Optical Controller Failure	TX 6 was detected without TX 4 and/or TX 5.
110	Optical Error	Transmittance Calibration Failure	General Tx Calibration Failure.
111	Processing Warnings	Can not unload cards, waste tray is not available	SEQ 60: Waste tray is not installed while attempting to unload a card.
112	Processing Warnings	Can not unload cards, waste tray is full	SEQ 60: Waste tray is full while attempting to unload a card.
113	Processing Warnings	Internal Instrument Temperature is HIGH	ENV_TASK: The average inside temperature is high with the exhaust fans ON.
114	Processing Errors	Bar Code Reader failure at Slot:	Get Cassette Info: Card sensor saw the card but the BarCode reader did not.
115	Processing Errors	Cassette button memory failure	Get Cassette Info: Could not successfully read the touch memory.
116	Fatal Errors	Call bioMerieux	DATATASK: could not store new wellmap into RAM.
117	Hardware Errors	FLASH Memory Failure	DATATASK BOOT: Failed Flash Verify of wellmaps, Could not store the defaults to FLASH.
118	Hardware Errors	FLASH Memory Failure	DATATASK BOOT: Failed to verify the wellmaps in the flash. The instrument may not have any wellmaps now.
119	Processing Errors	Inoculum source not available for Slot:	Get Cassette Info: Inoculum source is more than 2 tubes away.
120	Processing Errors	SCS and Bar Code Reader conflict at Slot:	Get Cassette Info: The BarCode reader and card sensor saw a card but SCS did not.
121	Processing Errors	SCS and Bar Code Reader conflict at Slot:	Get Cassette Info: The SCS says that a card is there but the BarCode reader and card sensor do not.

continued…

#	ALARM MESSAGE (MAJOR)	ALARM MESSAGE (MINOR)	DESCRIPTION OF ERROR / SOURCE OF ERROR
122	Processing Errors	Unknown Card Type at Slot:	Get Cassette Info: could not find a matching wellmap to target card type.
123	Processing Errors	Card has expired at Slot:	Get Cassette Info: has detected a card that has expired.
124	Processing Errors	SCS information has errors as Slot:	Get Cassette Info: SCS says to dilute into an 'I' card.
125	Processing Errors	SCS information has errors as Slot:	Get Cassette Info: SCS says pipette into card but the card is type 'I'
126	Processing Errors	SCS memory contains old information that has previously been processed	Get Cassette Info: The current cassettes SCS data has been previously processed.
127	Processing Errors	Reader Error Occurred	SEQ: Current Validated Optical System do not match the card type. (Optics have failed)
128	Processing Errors	An optical system is not available for card type in slot:	Get Cassette Info: No valid optical systems exists for target card type.
129	Processing Warnings	Diluent Level Low	Boat Management: has verified the diluent level and it is too low for the current cassette.
130	Processing Warnings	Tip Level Low	Boat Management: has verified the straw level and it is too low for the current cassette.
131	Processing Warnings	Insufficient carousel slots to process this cassette	Boat Management: has verified the number of available slots and has failed.
132	Processing Errors	SCS information has errors as Slot:	Get Cassette Info: SCS says pipette into card but now card is there.
133	Processing Errors	SCS information has errors as Slot:	Get Cassette Info: SCS says to dilute into a tube with no card.
134	Processing Errors	Grouping Error at Slot:	Get Cassette Info: Pipette source and destination are of different groups.(N or P)
135	Processing Errors	Inoculum source not available for Slot:	Get Cassette Info: No Inoculum source for the target 'S' card
136	Processing Error	Pipettor Failure	When the pipettor system has a pending error condition and a new cassette is loaded into the instrument requiring the use of the pipettor, boat management will attempt to clear the pending error by sending a pipettor initialization command to the pipettor SPN board. An error will be generated if this initialization fails.
137	Processing Errors	SCS information has errors as Slot:	Get Cassette Info: Pipette source and destination are of different groups.(N or P)
138	Processing Errors	SCS information has errors as Slot:	Get Cassette Info: Pipette source is type 'S'
139	Processing Errors	Bar Code Reader failure at Slot:	Get Cassette Info: has found duplicate Barcodes in the same cassette.
140	Fatal Errors	Call bioMerieux	Exception Handle: Buss/Address error.
141	Fatal Errors	Call bioMerieux	Main Heap is full and we are adding the reserve.
142	Processing Warnings	Power Fail. System will park until power is restored	UPS has signaled a POWER FAIL
143	Processing Warnings	The Uninterruptible Power Supply has a Low Battery	UPS has signaled a LOW BATT

continued…

#	ALARM MESSAGE (MAJOR)	ALARM MESSAGE (MINOR)	DESCRIPTION OF ERROR / SOURCE OF ERROR
145	Optical Error	Fluorescence Calibration Failure	Fluorescence Validation Failure(SYS_TASK or USER LCD) Check Log File for details.
146	Initialization Error	Vacuum System Failure	The vacuum-sealer SPN board was not auto-detected during system boot. This will only occur if DML $vacuum_en=1 and the vacuum-sealer SPN board was not auto-detected.
147	Initialization Error	Card Sealer Failure	The vacuum-sealer SPN board was not auto-detected during system boot. This will only occur if DML $sealer_en=1 and the vacuum-sealer SPN board was not auto-detected.
148	Initialization Error	Pipettor Failure	The pipettor SPN board was not auto-detected during system boot. This will only occur if DML $pipetter_en=1 and the pipettor SPN board was not auto-detected.
149	Initialization Error	Dispenser Failure	The diluter SPN board was not auto-detected during system boot. This will only occur if DML $diluter_en=1 and the diluter SPN board was not auto-detected.
150	Processing Error	Dispenser Failure	During pipettor/diluter processing, if the diluter SPN board fails the diluter fill command, up to 5 retries attempts will be made to fill the shot tube. If the retries fail to fill the tube, the card will be terminated and an error message will be generated.
151	Hardware Errors	Internal Instrument Temperature Controller Failure	ENV_TASK: Inside thermister is not installed correctly.
152	Processing Error	Pipettor Failure	During pipettor/diluter processing, if the pipettor SPN board has a pending error condition from the previous card, a pipettor initialization command will be sent to the SPN board. An error will be generated if this initialization fails.
153	Initialization Error	Vacuum System Failure	When the vacuum system has a pending error condition and a new cassette is loaded into the instrument, boat management will attempt to clear the pending error by sending a vacuum initialization command to the vacuum-sealer SPN board. An error will be generated if this initialization fails.
154	Initialization Error	Card Sealer Failure	When the sealer system has a pending error condition and a new cassette is loaded into the instrument, boat management will attempt to clear the pending error by sending a sealer initialization command to the vacuum-sealer SPN board. An error will be generated if this initialization fails.
155	Fatal Errors	Call bioMerieux	SYS_Task says that the Main Heap is less than 20 free.

continued…

#	ALARM MESSAGE (MAJOR)	ALARM MESSAGE (MINOR)	DESCRIPTION OF ERROR / SOURCE OF ERROR
156	Host Communication Errors	Card data has been lost	Data task has erase a data sector that contains untransmitted data in the FCT
157	Host Communication Errors	Card data has been lost	Data task has erase a data sector that contains untransmitted data.
158	Processing Warnings	The fluorescence is approaching calibration limits	VAL-FLR was just processed. Internal settings are approaching calibration limits.
159	Initialization Errors	Transport Failure	Network: Transport were not installed and should be.
160	Hardware Errors	Internal Data Failure	SYS Task makes a call to verify the all SPiN Variables.
161	Hardware Errors	Internal Data Failure	SYS Task makes a call to verify the all SPiN Variables.
162	Hardware Errors	Internal Data Failure	SYS Task makes a call to verify the all SPiN Variables.
163	Hardware Errors	Internal Data Failure	SYS Task makes a call to verify the all SPiN Variables.
164	Hardware Errors	Internal Data Failure	SYS Task makes a call to verify the all SPiN Variables.
165	Hardware Errors	Internal Data Failure	SYS Task makes a call to verify the all SPiN Variables.
166	Hardware Errors	Internal Data Failure	SYS Task makes a call to verify the all SPiN Variables.
167	Hardware Errors	Internal Data Failure	SYS Task makes a call to verify the all SPiN Variables.
168	Hardware Errors	Internal Data Failure	SYS Task makes a call to verify the all SPiN Variables.
169	Hardware Errors	Internal Data Failure	SYS Task makes a call to verify the all SPiN Variables.
170	Optical Error	Fluorescence Calibration Failure	FLR-POS: Failure to calibrate the reference channel during FLR-POS.
171	Optical Error	Fluorescence Requires Liquid Calibration	FLR-POS: Failure to calibrate the offset during FLR-POS.
172	Optical Error	Fluorescence Calibration Failure	FLR-POS: Optical Shuttle failed to extend.
173	Processing Errors	Additional cards were found with calibration/qc cards	A cassette was loaded with QC-D 007 cards and other types of cards were found in the cassette.
174	Processing Errors	Additional cards were found with calibration/qc cards	A cassette was loaded with QC-D 007 cards but the pattern did not match 011111111110.
175	Processing Warnings	Can not unload cards, waste tray is not available	SEQ 120: Waste tray is not installed while attempting to unload a card.
176	Processing Warnings	Can not unload cards, waste tray is full	SEQ 120: Waste tray is full while attempting to unload a card.
177	Optical Error	Fluorescence Calibration Failure	When fluorescence validation with a card(FLR-CAL card) fails.
178	Optical Error	Fluorescence Calibration Failure	FLR-Val: Soft Offset Failed.
180	Host Communication Errors	Communication Failure	More than 250 Commands are in the Q for the APL?

continued…

#	ALARM MESSAGE (MAJOR)	ALARM MESSAGE (MINOR)	DESCRIPTION OF ERROR / SOURCE OF ERROR
181	Processing Warnings	Incubator Temperature is HIGH	get_cassette_info: Incubator Temperature is High
182	Processing Warnings	Incubator Temperature is LOW	get_cassette_info: Incubator Temperature is Low
183	Processing Warnings	Internal Instrument Temperature is HIGH	get_cassette_info: Inside Temperature is HIGH
184	Initialization Error	Card Transport System Failure	The front paddle-transport system failed the range of motion test during system boot.
185	Initialization Error	Card Transport System Failure	The left paddle-transport system failed the range of motion test during system boot.
186	Initialization Error	Card Transport System Failure	The back paddle-transport system failed the range of motion test during system boot.
187	Initialization Error	Card Transport System Failure	The right paddle-transport system failed the range of motion test during system boot.
188	Processing Warnings	Can not unload cards, waste tray is not functional	SEQ 60: unload card but the stacker installed=1 functional=0
189	Hardware Errors	Optical Controller Failure	SEQ 60: HCB analog test failure
190	Hardware Errors	Optical Controller Failure	SEQ 120: HCB analog test failure
191	Hardware Errors	FLASH Memory Failure	DATATASK: Failed to store a new wellmap into the Flash. See Log for more details.
192	Hardware Errors	FLASH Memory Failure	DATATASK: Could not Flush the wellmaps.
193	Hardware Errors	FLASH Memory Failure	DATATASK: Could not Tagged Data as being Sent.
194	Hardware Errors	FLASH Memory Failure	DATATASK: Could not Remove the Target Command from the FCT.
195	Hardware Errors	FLASH Memory Failure	DATATASK: Could not Program the Test Eject Packet.
196	Hardware Errors	FLASH Memory Failure	DATATASK: Could not Program the Test Load Packet.
197	Hardware Errors	FLASH Memory Failure	DATATASK: Could not Program the Test Info Packet.
198	Hardware Errors	FLASH Memory Failure	DATATASK: Could not Program the Card Data Packet.
199	Fatal Errors	Call bioMerieux	Fatal Error Handle was called.
200	Fatal Errors	Call bioMerieux	Minor Error Handle was called.
201	Hardware Errors	Optical Controller Failure	Default optical configuration does not match the plug-n-played TX1 A
202	Hardware Errors	Optical Controller Failure	Default optical configuration does not match the plug-n-played TX2 A
203	Hardware Errors	Optical Controller Failure	Default optical configuration does not match the plug-n-played TX3 A
204	Hardware Errors	Optical Controller Failure	Default optical configuration does not match the plug-n-played FLR A
205	Hardware Errors	Optical Controller Failure	Default optical configuration does not match the plug-n-played TX1 B
206	Hardware Errors	Optical Controller Failure	Default optical configuration does not match the plug-n-played TX2 B

continued…

#	ALARM MESSAGE (MAJOR)	ALARM MESSAGE (MINOR)	DESCRIPTION OF ERROR / SOURCE OF ERROR
207	Hardware Errors	Optical Controller Failure	Default optical configuration does not match the plug-n-played TX3 B
208	Hardware Errors	Optical Controller Failure	Default optical configuration does not match the plug-n-played FLR B
209	Hardware Errors	FLASH Memory Failure	Could not Erase a Sector. During switch bank.
210	Processing Errors	Cassette button memory failure	Get Cassette Info: We are in 'Cassette Only' mode but the Touch Memory has SCS Data?
211	Processing Warnings	The fluorescence is approaching calibration limits	FLR: Finger Print values are are approaching calibration limits.
212	Optical Error	Fluorescence Calibration Failure	FLR-POS: Final Fsteps was calculated to the Rail.
213	Processing Warnings	The fluorescence is approaching calibration limits	FLR-POS: Final Fsteps is close to the Rail.
214	Processing Errors	Reader Error Occurred	SEQ: During an unload, the optical interrupt TX1 is not functional.
215	Processing Warnings	The fluorescence is approaching calibration limits	SYS_TASK: Head A was not done a VALFLUOR in more than 5 days.
216	Processing Warnings	The fluorescence is approaching calibration limits	SYS_TASK: Head B was not done a VALFLUOR in more than 5 days.
217	Hardware Errors	Optical Controller Failure	Seq Task: Dark current on FLR A
218	Hardware Errors	Optical Controller Failure	Seq Task: Dark current on TX1 A
219	Hardware Errors	Optical Controller Failure	Seq Task: Dark current on TX2 A
220	Hardware Errors	Optical Controller Failure	Seq Task: Dark current on TX3 A
221	Hardware Errors	Optical Controller Failure	Seq Task: Dark current on FLR B
222	Hardware Errors	Optical Controller Failure	Seq Task: Dark current on TX1 B
223	Hardware Errors	Optical Controller Failure	Seq Task: Dark current on TX3 B
224	Hardware Errors	Optical Controller Failure	Seq Task: Dark current on TX2 B
225	Optical Error	Fluorescence Calibration Failure	Warm Lamp has detected a Noisy Flash Lamp
226	Processing Warnings	The fluorescence is approaching calibration limits	SeqTask: Reference channel or internal 2 volt was out of range.
227	Optical Error	Transmittance Calibration Failure	Tx BurnIn Calibration Failure
228	Optical Error	Transmittance Calibration Failure	Tx BurnIn Optical Interrupt Failure
229	Hardware Errors	Optical Controller Failure	Optical Interrupt not functional before reading card.
230	Processing Errors	Reader Error Occurred	The Carousel has slipped steps. We might have read the wrong card. Unload all cards.
231	Processing Error	Card Transport System Failure	After a cassette has passed through the diluter and pipettor processing section, the front transport performs a check home. If the step loss is greater then 50 steps, all the cards in that cassette will be terminated.
232	Processing Error	Load Failure	After cards have been loaded into the incubator, the back transport performs a check home. If the step loss is greater than 50 steps, the reader will be signaled to unload all the cards that were loaded from the cassette.

continued…

#	ALARM MESSAGE (MAJOR)	ALARM MESSAGE (MINOR)	DESCRIPTION OF ERROR / SOURCE OF ERROR
233	Processing Error	Card Sealer Failure	The vacuum/sealer SPN board has failed to execute a sealer off command during cassette processing.
234	Processing Errors	Grouping Error at Slot:	Get_Cassette_Info '_SS' where S+ and S- are together.
235	Processing Warnings	Can not unload cards, waste tray is not functional	SEQ 120: unload card but the stacker installed=1 functional=0
236	Processing Warnings	Instrument status is cleaning	Carousel in cleaning mode while attempting to load cards.
237	Processing Warnings	No cards found	After cassette was loaded into the instrument, both the bar code reader and the card separator did not detect any cards.

Appendix E: **Alignment Procedures**

NOTE: The following text of this appendix is for INFORMATION PURPOSES ONLY. Always refer to the Official Release Document for the approved Alignment Procedures. See Document Control for the approved drawings.

WARNING! Place boats back in the 1, 4, 5 and 6 Transport position prior to **ALIGN_MODE_OFF**.

WARNING! Do **SAVE_ALIGNMENTS** prior to leaving instruments.

WARNING! Do **ALIGN_MODE_OFF** prior to leaving instruments.

WARNING! Perform **BOAT_ADVANCE** after **ALIGN_MODE_OFF.**

APPLICATION		REVISIONS			
NEXT ASSY	USED ON	LTR	DESCRIPTION	DATE	APPROVED
		C	SEE DCN (PCN #I99-0482-3) DAH Standardized revision levels so all pages reflect revision level in the title block of document as stated.	11/22/99	
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INDEX OF ACTIVE SHEETS

THIS INDEX LISTS THE REVISION STATUS OF THE SHEETS OF THIS DRAWING.
SEE SHEET 1 FOR DRAWING REVISION STATUS.

SHEET NO.	REV LTR	SHEET NO.	REV LTR	SHEET NO.	REV LTR	SHEET NO.	REV LTR	SHEET NO.	REV LTR
1	D								
2	D								
3	D								
4	D								
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1. Introduction

This procedure covers the adjustments and alignments required on the Vitek 2 (60) and Vitek 2XL (120) instruments. Some adjustments are mechanical in nature, some electrical, but most will simply be software adjustments. The software adjustments work by storing the required step count from a home sensor in non-volatile memory. (Rather than adjust the physical position of a sensor, the number of steps from the sensor to where the device needs to be is stored in memory.)

1.1. Procedure layout

This alignment procedure is divided into multiple sections, sub-sections, and steps. The sections cover main functional parts of the instrument and are numbered with a single number followed by a period (example: **3. Pipettor**). The sub-sections under a section each cover a separate adjustment which is required for that section and are numbered with two numbers separated by a period and followed by a period (example: **3.1. Rotor home**). Under each sub-section are one or more steps required to perform the adjustment in that sub-section. Steps are numbered with three numbers separated by periods and ending in a period (example: **3.1.2.**).

Differences in the alignment process between the Vitek 2 and Vitek 2XL are noted where necessary as “60” for the Vitek 2 and “120” for the Vitek 2XL.

1.2. Use of procedure

When aligning a previously aligned instrument, you may use only those sections or sub-sections which are required to make the needed alignment. If the alignment in one section or sub-section is dependent on another, then it is noted.

Within a section, sometimes the first or last sub-section may be required even though the remaining sub-sections may be performed independently of each other. When this is the case, the sub-section will have **(required)** in its heading.

Please note that sub-sections should be performed in their entirety. Do not perform individual steps within a sub-section. It is also recommended in most cases you will want to perform a complete section and not do a sub-section alignment by itself.

Obviously if the instrument has never been aligned or the status is unknown, the complete procedure should be followed.

1.3. Conventions

- The prompt you would see on your diagnostic terminal is referred to as **`Prompt>`** throughout the procedure. The actual prompt you see will vary by instrument.
- Throughout this procedure, commands which must be typed on the keyboard are found as bolded all caps in quotes. Do not type the quotes when entering commands. It is also not necessary to type in all caps. Lower case commands work the same. (Example: **`"ALIGN_DIL_FLUID"`**).
- Keys on the keyboard which must be pressed will be found as bolded, capitalized text in single quotes. (Example: **`'H'`** key, **`'Enter'`** key).
- Other highlighted text will be bolded to bring attention to it.
- Throughout the procedure as well as prompts and text from the diagnostic terminal, the words **"out"** and **"in"** are used relating to alignment. "Out" is used to indicate direction away from the home sensor for that particular motor. "In" is used to indicate direction towards the home sensor for that particular motor.

1.4. General Recommendations

- During many motor alignments the **`'H'`** key is used to home the motor and return to the aligned position. This can be quite useful in checking your alignment while you are doing it and is recommended in most cases.

1.5. Reference Documents

- 510731 Vitek 2 user's manual
- 530602 Jumper document
- VK2PRM Firmware adjustments

1.6. Required Tools/Material

- Data/Diagnostic Reader Cable. P/N 186075-10.
- Terminal or PC capable of VT 100 terminal emulation and the appropriate RS-232 cable to attach terminal or PC to 25 pin female connector labeled diagnostic on Vitek 2 cable.
- One Pipettor/Diluter Accessory Kit. P/N V1219.
- Four Quads (60), Eight Quads (120). P/N 533208-1 or 533272-1
- One Boat. P/N 531106-1
- One Cassette w/button memory installed. P/N 530136-1
- Fifteen 12 x 75 mm plastic test tubes. P/N 396547-1
- Fifteen 64 well cards, at least two of which must be bar coded. P/N 001021-1 or 001022-1
- One 3mm alignment pin. P/N 371342-1
- Hand tools including Phillips and slotted blade screwdrivers and set of metric Allen wrenches.
- Feeler Gage with a 0.002” thick blade

2. Alignment Setup

This section will go through the necessary steps to prepare an instrument for alignment. In most cases, this section will have to be performed prior to performing any of the remaining sections in this procedure.

2.1. Instrument Configuration

The instrument must be properly configured before it can be aligned. This sub-section may be skipped for instruments which have been configured and aligned once before

2.1.1. Refer to document 530602 to verify that all boards are jumpered correctly. (Instrument should be off.)

2.2. Disposable Installation

The instrument must have quads, straws, and a shot tube before it can be properly aligned.

2.2.1. Insert a shot tube into the diluter assembly, referring to the user's manual as needed for instructions.

Note: Tubing is not required for alignment purposes.

2.2.2. Insert straws into the drum, referring to the user's manual as needed for instructions.

2.2.3. Insert all quads into the instrument, referring to the user's manual as needed for instructions.

2.3. Firmware Configuration

The firmware must be set to the proper diagnostic mode before you can align most parts of the instrument. Failure to do so will result is some alignment commands not working correctly, or not working at all.

2.3.1. At the **`Prompt>`** type **`"ALIGN_MODE_ON"`** and hit **`'Enter'`**. Answer **`'Y'`** when prompted. This configures the instrument for alignment and reboots.

2.3.2. Wait for completion of the reboot before continuing.

2.3.3. **For a 120**, at the **`Prompt>`** type **`"CAROUSEL A"`** or **`"CAROUSEL B"`** and hit **`'Enter'`** depending on which carousel, cam, autoloader or stacker you will be aligning. Carousel A is the one closest to the center of the instrument and Carousel B is the one on the right, closest to the load door.

3. Transport System

Alignment mode must be enabled for this section to be performed properly.

Note: During transport alignment you will be stepping boats against the exterior rail of the base pan. If helpful, as an aid, you may place the 0.002" blade of the feeler gage into the appropriate corner of the base pan for the transport being aligned. Step the boat in as instructed until you first start to feel some pressure on the paper from the boat. This can help you determine when the boat just touches the rail.

3.1. Front Transport

When the front transport is properly aligned the paddle will cause the boat to just touch the left side rail. (The free play of the boat between the left side rail and the paddle just is removed.)

3.1.1. Place an empty boat in the front left corner of the base pan.

Note: Raise paddles by hand if necessary to place boat in this position.

3.1.2. At the **`Prompt>`** type **`"ALIGN_FTRANS"`** and hit **`'Enter'`**. This starts the front transport alignment routine.

3.1.3. Following the prompts on the screen, position the boat as requested and adjust the front transport so the boat is just barely touching the left side rail. Do not **force** the boat into the rail under pressure from the paddle.

3.1.4. Press **`'Enter'`** when done to save the adjustment. If the paddle does not look centered in the boat pocket after completion of this alignment then recheck alignment, belt tension or transport itself for problem.

3.2. Left Transport

When the left transport is properly aligned the paddle will cause the boat to just touch the back rail. (The free play of the boat between the back rail and the paddle just is removed.)

3.2.1. Place an empty boat in the front left corner of the base pan.

Note: Raise paddle by hand if necessary to place boat in this position.

3.2.2. At the **Prompt>** type **"ALIGN_LTRANS"** and hit **'Enter'**. This starts the left transport alignment routine.

3.2.3. Following the prompts on the screen, position the boat as requested and adjust the left transport so the boat is just barely touching the back rail. Do not force the boat into the rail under pressure from the paddle.

Caution: The boat will naturally want to tilt when it is moving towards the back rail. This is normal. It is important for this alignment that the boat stay tilted and not be squared up against the back rail of the base pan. If you accidentally square up the boat during this alignment, change the step size to 100 and move out (**'O'**) twice. This will allow the boat to tilt as is does normally.

3.2.4. Press **'Enter'** when done to save the adjustment. If the paddle does not look centered in the boat pocket after completion of this alignment then recheck alignment, belt tension or transport itself for problem.

3.3. Back Transport

When the back transport is properly aligned the paddle will cause the boat to just touch the right side rail. (The free play of the boat between the right side rail and the paddle just is removed.)

3.3.1. Place an empty boat in the back right corner of the base pan.

Note: Raise paddle by hand if necessary to place boat in this position.

3.3.2. At the **Prompt>** type **"ALIGN_BTRANS"** and hit **'Enter'**. This starts the back transport alignment routine.

3.3.3. Following the prompts on the screen, position the boat as requested and adjust the back transport so the boat is just barely touching the right side rail. Do not force the boat into the rail under pressure from the paddle.

3.3.4. Press **'Enter'** when done to save the adjustment. If the paddle does not look centered in the boat pocket after completion of this alignment then recheck alignment, belt tension or transport itself for problem.

3.4. Right Transport

When the right transport is properly aligned the paddle will cause the boat to just touch the back rail. (The free play of the boat between the back rail and the paddle just is removed.)

3.4.1. Place an empty boat in the back right corner of the base pan.

Note: Raise paddle by hand if necessary to place boat in this position.

Caution: It is important that the boat be squared against the back rail (both rear feet touching back rail) when the alignment is completed.

3.4.2. At the **`Prompt>`** type **`"ALIGN_RTRANS"`** and hit **`'Enter'`**. This starts the right transport alignment routine.

3.4.3. Following the prompts on the screen, position the boat as requested and adjust the right transport so the boat is just barely touching the back rail. Do not force the boat into the rail under pressure from the paddle.

3.4.4. Press **`'Enter'`** when done to save the adjustment. If the paddle does not look centered in the boat pocket after completion of this alignment then recheck alignment, belt tension or transport itself for problem.

4. Bar Code Reader

Alignment mode must be enabled for this alignment to work correctly.

4.1. Card Separator Position (Bar Code Base)

The bar code base position is correct when the bar code separator is centered between two cards in a cassette at a bar code reading position. The separator bracket should be positioned to be perpendicular to the cassette and adjusted as far back from the cassette as possible, but still maintain enough card pressure to separate the two cards completely.

4.1.1. Place fifteen (15) 64 well cards and fifteen (15) test tubes into positions 1 through 15 of a cassette and place the cassette into a boat positioned at the front left position of the basepan.

4.1.2. At the **`Prompt>`** type **`"ALIGN_BARCODE"`** and hit **`'Enter'`**. This will start the bar code alignment routine.

4.1.3. Following the prompts on the screen, hit the **`'Spacebar'`** when the boat and cassette are positioned as requested. The boat will then be moved to the Card Separator.

Note: Open the load door for greater visibility of the cassette.

4.1.4. Press the **`'R'`** key seven times to move the cassette so the Card Separator is to the left of card 8. (Position will be reported on the diagnostic terminal).

4.1.5. Following the prompts on the screen, press the **`'I'`** or **`'O'`** keys until the card separator is centered between the two cards and applies approximately equal pressure to the back of each one. The **`'I'`** key will increase pressure on the right card, and the **`'O'`** key will increase pressure on the left card.

Note: The pressure can be checked by gently trying to move the cards side to side (left to right) with your finger. The cards must be fully seated (down) into the cassette when you try this. Push the card down if necessary to seat it into the cassette.

It is necessary to use the **`'R'`** and **`'L'`** keys to check the other card positions in the cassette. Adjust the card separator position so that it best meets the criteria above for all card positions. **It will not be exactly the same for all positions.**

4.1.6. Use the **'L'** key as required to move the cassette so the Card Separator is to the left of card 1.

4.1.7. Remove the cassette from the boat. (Open the load door if necessary).

4.1.8. Press the **'R'** key three times to move the boat so the Card Separator is at card position 4. Verify correct position by looking at reported position on the diagnostic terminal.

4.1.9. Now gently press on the left side of the boat (to the right) to remove any play from the transport relative to the boat, then remove the pressure.

4.1.10. Press the **'X'** key to activate the bar code scanner.

4.1.11. Loosen the two screws holding the bar code reader bracket and move it until the center of the laser beam is hitting a point 20mm ± 1mm from the inner side of the boat measured from the bump out for the right paddle pocket. Tighten the bar code bracket mounting screws, verifying the beam position has not moved after tightening.

4.1.12. Press the **'Space Bar'** to stop the bar code reader from firing and get the **Prompt>** back.

4.1.13. Press **'Enter'** when done to save the bar code separator adjustment.

5. Touch Memory Contacts

Two types of touch memory contacts are in use. One is adjustable and one is not. If you have the non-adjustable type of contacts (contact block mounting hole is not slotted) then skip the **Touch memory contact position** sub-section below.

5.1. Touch memory contact position

The touch memory contacts are correctly positioned when they apply light pressure to the touch memory contacts on the cassette even when the cassette is positioned as far forward in a boat as possible.

5.1.1. Loosen the screw holding the mounting block for the touch memory contacts just enough so the block can be moved forward or backward in position. Remove any boat and cassette that may be in front of the touch memory contacts before continuing.

5.1.2. Position the contact mounting block's front edge so that it is 17.5mm (.690") from and is square to the front face of the base pan center mount.

5.1.3. Tighten the screw holding the touch memory contact block.

5.2. Touch memory check

5.2.1. Manually place and position an empty boat in the front left corner of the instrument. Next place a cassette with button memory installed into the boat.

5.2.2. Move the boat to the right by hand, verifying that the cassette depresses the touch memory contacts as it moves past. Stop the cassette when it is centered with the touch memory contact block.

5.2.3. At the **`Prompt>`** type **`"TOUCH_SEARCH"`** and hit **`'Enter'`**. The instrument will try to read the touch memory in the cassette and report its findings. Verify the phrase **`"64K BIT TOUCH MEMORY"`** is included in the report displayed on the terminal. If not, verify the cassette is centered properly with the contact block and/or the block is aligned properly.

5.2.4. Remove the cassette from the boat and at the **`Prompt>`** again type the command **`"TOUCH_SEARCH"`** and hit **`'Enter'`**. Verify the phrase **`"64K BIT TOUCH MEMORY"`** is no longer included in the report displayed on the terminal

6. Diluter

The **Tilt home position** sub-section must be performed prior to performing the **Tilt down position** sub-section.

Note: Associated tubing is not required on the diluent tube (shot tube) for this alignment.

6.1. Tilt home position

The shot tube must be centered in the sensor that senses the fluid level.

6.1.1. At the **Prompt>** type **"ALIGN_DIL_FLUID"** and hit **'Enter'**. This will step the tube in and out of the sensor to find the center point. This is an automatic adjustment.

6.2. Tilt down position

When dispensing diluent, the shot tube needs to be perfectly vertical to dispense fluid into a test tube.

6.2.1. At the **Prompt>** type **"ALIGN_DIL_DOWN"** and hit **'Enter'**. This will tilt the shot tube down so that you can adjust how vertical it is.

6.2.2. Following the prompts on the screen, adjust the shot tube position until the tube looks perfectly vertical by eye. **'O'** will move the tube clockwise, **'I'** counterclockwise.

Note: This must be done *after* the tilt home position has been set in the previous sub-section.

6.2.3. Press **'Enter'** when done to save the adjustment. Shot tube will move to approximately the two o'clock position.

6.3. Pump home position

The diluter pump must have enough free travel to properly dispense the fluid from the shot tube.

6.3.1. At the **Prompt>** type **"ALIGN_DIL_PUMP"** and hit **'Enter'**. This adjustment is made automatically by the software. If the terminal does not display "successful" on the screen then you have a pump failure that must be repaired.

7. Pipettor

The **Rotor home**, **Vertical home** and **Rotor down** sub-sections are all interdependent. Be sure to check each of these when performing one of these alignments.

7.1. Tip home

The end of the tip should be flush with the tip opening in the snout housing.

Caution: Do not step tip inward further than flush with the housing, damage may occur.

7.1.1. At the **Prompt>** type **"ALIGN_TIP_HOME"** and hit **'Enter'**. This starts the tip home alignment routine.

7.1.2. Following the prompts on the screen, adjust the tip position until it is flush with the snout housing. Press the **'H'** key when done to verify the proper position during this alignment. Readjust if necessary.

7.1.3. Press **'Enter'** when done to save the adjustment. The pipettor will now move to its normal default state (located next to drum).

7.2. Drum check

This verifies the drum can move and stop reliably at each of the three finger locations.

7.2.1. Tilt the drum up to allow the fingers to be observed and empty drum of any straws if necessary.

7.2.2. At the **Prompt>** type **"DRUM_CYCLE"** and hit **'Enter'**. This cycles the drum through one of its three possible positions.

7.2.3. Verify the drum moves freely and the finger adequately blocks the straw slot consistently in the bottom of the drum. Repeat this command for each finger in the drum (total of three times).

7.3. Rotor home

The rotor should be perfectly horizontal when home.

Caution: Verify the rotor home optical sensor does not rub against the pipettor tip motor housing when the rotor is turned vertical -90deg. From home. Adjust sensor back as necessary to prevent rubbing.

7.3.1. At the **Prompt>** type **"ALIGN_ROTOR_HOME"** and hit **'Enter'**. This starts the rotor home alignment routine.

7.3.2. Following the prompts on the screen, adjust the rotor position until it looks horizontal by eye relative to bottom of the drum.

Tip: To aid in this adjustment, place a 6 inch scale minimum or equivalent on the flat part of the bottom of the rotor. Let the scale extend underneath the drum assembly. Compare the flat on the bottom of the drum with the scale top. When the two are parallel, the rotor should be horizontal.

Alternatively, you may move the vertical drive belt by hand to lower the pipettor assembly enough so that you can visually compare the bottom of the scale with the middle horizontal cross member of the front cover.

7.3.3. Press **'Enter'** when done to save the adjustment.

7.4. Vertical home

The vertical position should be such that when the rotor is home and the tip is extended, it enters the center of a straw sitting on the drum plate.

Note: It may be necessary to add one or more pipettor mount shims in order to adequately set the pipettor tip front to back centering with respect to the straw opening. If shims are added or removed repeat this sub-section completely until all requirements are met

7.4.1. Verify the drum contains straws and is tilted down into its normal position.

7.4.2. At the **Prompt>** type **"ALIGN_VERT"** and hit **'Enter'**. This starts the vertical home alignment routine.

7.4.3. Following the prompts on the screen, adjust the tip position up and down until it looks centered in the straw that is laying on the drum plate.

Tip: It may be helpful to tilt up the drum to get a better view of the straw on the drum plate. Be careful when tilting the drum back down over the straw not to pinch it.

7.4.4. Press the **'X'** key to extend the tip into the straw and check how well centered you are. If the straw moves up when you hit **'X'** then you are too high. If the straw moves down then you are too low.

7.4.5. Adjust the vertical position up or down as needed until the straw does not move when you hit **'X'**.

7.4.6. Press **'Enter'** when done to save the adjustment.

7.4.7. Manually press the plunger in the center of the solenoid directly below the slide plate underneath the drum, to allow you to remove the straw.

7.5. Tip extended

The tip should extend enough to guarantee the straw is wedged firmly onto the tip and seals against the pad on the drum. The drum should be down (horizontal) when performing this sub-section.

7.5.1. At the **Prompt>** type **"ALIGN_TIP_EXT"** and hit **'Enter'**. This starts the tip extended alignment routine.

7.5.2. Following the prompts on the screen, adjust the tip position in and out as needed until the tip just meets the end of the drum. Press the **'H'** key when done to verify the proper position during this alignment. Readjust if necessary.

7.5.3. Press **'Enter'** when done to save the adjustment.

7.6. Rotor down

The rotor should be perfectly vertical when rotated down.

7.6.1. At the **Prompt>** type **"ALIGN_ROTOR_DOWN"** and hit **'Enter'**. This starts the rotor down alignment routine.

7.6.2. Following the prompts on the screen, adjust the rotor position until it looks perfectly vertical by eye.

To aid in this adjustment, place a minimum of a 6 inch scale or equivalent on the flat part of the side (bottom when horizontal) of the rotor. Let the scale extend down parallel to the vertical guides for the assembly. Compare the vertical guides with the scale. When they are parallel, the rotor should be vertical.

Caution: Use of a straw which may have curvature may lead to an improper alignment. Use of a straight edge is recommend.

Tip: It can be helpful to position a cassette with a test tube underneath the pipettor assembly and watch how a tip enters the tube when you press the **'X'** key. If the bottom and top of a tip enter the test tube at the same relative point, then the rotor is vertical. If the top of a tip appears to move to the left or right of where the bottom of the tip entered the tube, then the rotor is not vertical. (This can also be caused by improper **Rotor home** and **Vertical home** alignments.)

7.6.3. Press **'Enter'** when done to save the adjustment. This will drop a straw if one was picked up.

7.6.4. To check that you are stopping at the correct position type **"ALIGN_ROTOR_DOWN"** and hit **'Enter'** at the **Prompt>**. If not, readjust as needed by following the instructions above in this sub-section.

7.7. Pump home

The pump bellofram should be at a relaxed (neutral) state when the pump is setting at home and should have 340 steps of free travel.

7.7.1. At the **Prompt>** type **"ALIGN_PIP_PUMP"** and hit **'Enter'**. This starts the pipettor pump alignment routine.

7.7.2. Following the prompts on the screen, insert 3 mm pin when instructed by screen. Adjust the pump home position out slowly using the **'O'** key as instructed until the pin just drops out of the pump.

Note: It is important that you be in one step mode when making the last outward movement where the 3 mm pin drops. If not, reinsert the tool and manually step back in until the tool is held in place again so you can switch to one step mode.

7.7.3. Press **'Enter'** when done to save the adjustment.

7.8. Pipettor/Diluter Mechanical Alignment

The pipettor must be positioned so that it is centered over tube 15 of a cassette when the boat is fully against the left side rail. Also, the diluter shot tube must be positioned so that it is centered over tube 9 of a cassette when the pipettor is centered over tube 4.

7.8.1. Place a boat and cassette with empty test tubes in positions 4, 9 and 15 into the left front corner. Make sure the test tubes are properly centered and vertical in their holder in the cassette. The boat must be resting against the left side rail.

7.8.2. At the **Prompt>** type **"PIP_POINT"** and hit **'Enter'**. This will lower the pipettor without a straw.

7.8.3. Look at the front aluminum frame (also called the Rifle) supporting the Pipettor, Diluter, Stacker, etc. to determine which type you have. The **Original Rifle** is solid machined aluminum with a yellow coating. The **Newer Rifle** is cast aluminum with some machined surfaces. Follow the appropriate instructions below based on the Rifle type you have:

7.8.4. Follow instructions for your Rifle type identified in a previous step.

Original Machined Rifle: Loosen the two Allen head set screws, which clamp the support post, (located behind the pipettor mounting plate and rifle) just enough to allow for in and out adjustment **without sag**. Rotate the drum to a vertical position for access. Using the center Philips head screw on the front of the plate adjust the entire pipettor assembly in or out as needed to center the pipettor tip over the test tube in position 15 of the cassette. **Verify the pipettor plate did not rotate and is still parallel to the Rifle, then tighten the two allen head set screws securely.**

Newer Cast Rifle: Rotate the drum to a vertical position for access and loosen the Allen head set screw located directly above the center Philips head screw on the front of the plate. Using the center Philips head screw adjust the entire pipettor assembly in or out as needed to center the pipettor tip over the test tube in position 15 of the cassette. **Tighten the allen head set screw securely.**

7.8.5. Follow instructions for your Rifle type identified in a previous step.

Original Machined Rifle: Loosen the allen head set screw on the Pipettor Plate Clamp (lower left corner of the Pipettor mounting plate). Loosen the two Phillips head screws holding the pipettor plate to the intermediate support. Adjust the assembly left or right as needed to center the pipettor tip over a test tube in position 15 of the cassette. **Verify the pipettor plate did not rotate and is still parallel to the front frame then tighten the two Phillips screws and allen head set screw securely.**

Newer Cast Rifle: Loosen the two Phillips head screws holding the pipettor plate to the intermediate support. Adjust the assembly left or right as needed to center the pipettor tip over a test tube in position 15 of the cassette. **Tighten the two Phillips screws securely.**

7.8.6. Rotate drum back down to its horizontal position.

7.8.7. Move the boat and cassette of tubes to the right so that the tube in position 4 is now centered underneath the pipettor tip.

7.8.8. Press the **`'Space Bar'`** to end the **`PIP_POINT`** command and get the **`Prompt>`** back.

7.8.9. At the **Prompt>** type **"DIL_DOWN PIP_POINT"** and hit **'Enter'**. This will rotate the diluter to the down position and lower the pipettor again.

7.8.10. Slide the cassette to the right and center the test tube in position 4 under the pipettor point.

7.8.11. Follow instructions for your Rifle type identified in a previous step.

Original Machined Rifle: Loosen the Allen head set screw, which clamps the support post, (located behind the diluter mounting plate and rifle) just enough to allow for in and out adjustment **without sag**. Using the center Phillips head screw on the front of the plate adjust the assembly in or out as needed to center the diluter shot tube over the test tube in position 9 of the cassette. **Verify the diluter plate did not rotate or sag then tighten the allen head set screw securely**.

Newer Cast Rifle: Loosen the Allen head set screw located directly above the center Philips head screw on the front of the diluter plate. Using the center Philips head screw adjust the entire pipettor assembly in or out as needed to center the pipettor tip over the test tube in position 9 of the cassette. **Verify the diluter plate did not rotate or sag then tighten the allen head set screw securely**.

7.8.12. Loosen the Allen head set screw located behind the diluter mounting plate just enough to allow in and out movement. **without sag**.

7.8.13. Loosen the two Phillips head screws in the front holding the diluter plate to the intermediate support. Now adjust the assembly left or right as needed to center the diluter shot tube over a test tube in position 9 of the cassette. **Verify the diluter plate did not rotate before tightening securely the two Phillips screws .**

7.8.14. Press the **'Space Bar'** to end the **PIP_POINT** command and get the **Prompt>** back.

7.8.15. At the **Prompt>** type **"PIP_INIT DIL_INIT"** and hit **'Enter'**. This will reset both the pipettor and diluter to their normal states.

8. Vacuum Filler

8.1. Chamber down position

The vacuum chamber O-ring gasket should just touch a boat when properly aligned. During operation the software will move the chamber down farther and compress the foam washers under the drive nuts a preset amount.

Note: It is important that the mechanical phasing of the drive screws be correct before attempting this alignment. This means the drive nuts should compress the foam washers equally when applying pressure to the vacuum chamber against a boat.

8.1.1. Place a boat with a cassette into left rear corner of the base pan underneath the vacuum chamber.

Note: If necessary, type **"VAC_INIT"** and hit **'Enter'**. This will raise the chamber if needed.

8.1.2. At the **Prompt>** type **"ALIGN_VAC_DOWN"** and hit **'Enter'**. This starts the chamber down alignment routine.

8.1.3. Following the prompts on the screen, adjust the chamber position up and down as needed until the O-ring gasket just meets the top of the boat placed underneath. **'I'** is up and **'O'** is down.

Look at the heads of the three shoulder screws where they touch the drive nut they fasten. Slowly move the chamber down until you see the drive nut **just** starts to compress its foam washer and it just pulls away from the head of the shoulder screw. This occurs when the O-ring gasket just touches the boat.

8.1.4. Press **'Enter'** when done to save the adjustment.

The chamber will now return to home and then perform a quick test of the full down position. Verify that when the chamber moves down against the boat that the foam washer under each drive nut is compressed about 50% from its normal state.

8.1.5. Press the **'Space Bar'** to end the **ALIGN_VAC_DOWN** command and get the **Prompt>** back.

8.2. Vacuum Transducer Calibration

The vacuum level that is obtained during normal operation of the vacuum cycle must be between 0.89 ± 0.04 PSIA. This must be set (calibrated) using a calibrated, traceable, Absolute Pressure Gauge.

8.2.1. Disconnect the smaller vacuum line coming from the vacuum chamber at the pressure transducer on the Vac Seal SPN board and connect a tee fitting as required to connect your Absolute Pressure Gauge. Be sure to get the tubing connected to the same fitting it was originally attached.

Caution: Be careful not to break or crack the circuit board when removing the tubing.

8.2.2. At the **`Prompt>`** type **`"CAL_VAC"`** and hit **`'Enter'`**. This starts the vacuum transducer calibration routine.

8.2.3. Following the prompts on the screen, adjust the vacuum level up and down as needed until the Absolute Pressure Gauge reads 0.89 ± 0.04 PSIA.

Note: The screen will display the current set point and transducer reading in A/D counts. The keys for adjusting the set point up or down (**`"U"`** and **`"D"`**) do not run the pump. You must Test the set point (**`"T"`**) to run the pump and to see what vacuum level you obtain on your gauge.

Tip: It takes approximately 3 to 4 A/D counts for each 0.1 PSIA change in vacuum.

8.2.4. Press **`'Enter'`** when done to save the adjustment.

8.2.5. At the **`Prompt>`** type **`"VAC_CYCLE"`** and hit **`'Enter'`**. This runs a standard vacuum cycle. Verify the chamber runs through a complete cycle and the 0.89 ± 0.04 PSIA specification is met. If it is not, repeat this alignment starting at the beginning of this section.

8.2.6. When alignment is completed, disconnect Absolute Pressure Gauge and tubing. Be sure to reconnect vacuum chamber tubing to correct transducer fitting.

9. Sealer

9.1. Sealer position

The sealer wire needs to be positioned so that it will cut the straw off all cards within a distance of 1mm (.040") to 2.5mm (.10") from the card's edge.

9.1.1. Place a cassette containing 15 cards without straws in a boat located underneath the vacuum chamber. Remove any boats located on the back of the instrument base pan.

9.1.2. At the **Prompt>** type **"SEAL_INIT SEAL_DOWN"** and hit **'Enter'**. This will initialize the sealer and lower the sealer wire.

9.1.3. Loosen the two screws holding the sealer assembly to the center mount and adjust it in or out as needed so the sealer wire comes within 1.0mm (.040") to 2.5 mm (.10") in front of all cards in the boat as it is pushed past. It is very important that the sealer wire never come in contact with a card. The sealer wire must also be parallel to the front edge of all cards in the cassette.

Tip: It is helpful if you remove both end panels to aid in seeing the sealer wire.

9.1.4. Tighten the screws holding the sealer assembly when location is adjusted correctly.

9.1.5. At the **Prompt>** type **"SEAL_UP"** and hit **'Enter'**. This will raise the sealer wire.

9.1.6. Remove the cassette containing the 15 cards .

9.2. Sealer current

The sealer must conduct 8.5 amps through the sealer wire in order to reach the correct temperature.

9.2.1. At the **Prompt>** type **"LOOPK TEST_SEALER"** and hit **'Enter'**. This will turn on the sealer current and display it to the screen.

9.2.2. Adjust R14 on the Vacuum Sealer PCB until the screen displays 8.5 ± 0.1 amps.

9.2.3. Press the **'Space Bar'** to end the **LOOPK TEST_SEALER** command and get the **Prompt>** back.

10. Carousel

10.1. Carousel Selection

If aligning a 60 then skip this sub-section. If aligning a 120, this sub-section is required.

10.1.1. **For a 120**, at the **`Prompt>`** type **`"CAROUSEL A"`** and hit **`'Enter'`**. This will redirect all carousel alignment commands to Carousel A. You may complete the rest of this section to align Carousel A, then return back to this point.

10.1.2. **For a 120**, after Carousel A has been aligned, type **`"CAROUSEL B"`** and hit **`'Enter'`** to redirect all carousel alignment commands to Carousel B. You may complete the rest of this section to align Carousel B.

10.2. Home Offset

The home offset is properly aligned when the **first** (topmost) carousel slot of the quad that is still **within** the housing (upper left quad) is centered on the reader head drive mechanism and the card ejector.

Note: It is important the reader head be adjusted properly mechanically and lined up with the ejector blade and carousel before performing this alignment.

10.2.1. At the **`Prompt>`** type **`"MN CARO"`** and hit **`'Enter'`**.

10.2.2. Next at the **`Prompt>`** type **`"ALIGN_MOT"`** and hit **`'Enter'`**.

10.2.3. Following the prompts on the screen, move the carousel left or right as needed so that the first slot of the upper left quad is positioned so that the reader head drive mechanism is centered. Try to visually line up the top card guide rail of the reader head with the top of the carousel slot (peak of the arch of the slot). You can also visually line up the reader head belt with the bottom of the carousel slot. It is very important that the ejector blade moves freely in and out of the back of the carousel. (Blade can be moved by hand.) **`'O'`** will move the carousel clockwise, **`'I'`** counterclockwise.

Note: Press the **`'H'`** key when done to cycle the carousel. Verify your alignment and readjust if necessary.

Tip: It is helpful to remove the carousel access cover, rear access panel, and open up the transmittance and fluorescence optics, remove the stacker tray and hold up the stacker latch. If desired, also move the stacker push arm to the right.

10.2.4. Press **`'Enter'`** when done to save the adjustment.

10.3. Top Bias

The top bias is properly aligned when a carousel slot is centered on the reader head drive mechanism and the card ejector during a carousel slot read movement.

10.3.1. At the **Prompt>** type **"ALIGN_CARO_TOP"** and hit **'Enter'**.

10.3.2. Following the prompts on the screen, move the carousel left or right as needed so that the carousel slots are centered with the reader head drive mechanism. Visually line up the top card guide rail of the reader head with the top of the carousel slot (peak of the arch of the slot). The alignment software will automatically move to the next slot each time you make an adjustment.

Tip: It is helpful to remove the carousel access cover, rear access panel, and open up the transmittance and fluorescence optics, remove the stacker tray and prop up the stacker latch. If desired, also move the stacker push arm to the right.

10.3.3. After completing alignment, press **'G'** to check all 60 slots on all four quads. Press the **'Space Bar'** to stop the slot cycling.

Note: Make sure this is done with the carousel moving in a clockwise direction.

10.3.4. After checking how the alignment looks on one complete quad, you may find it necessary to readjust to give the best overall alignment for all 15 slots. Readjust as necessary if this is the case.

Example: When verifying alignment of the 15 slots in a quad, you notice that the slots range from being centered to off in only one direction (left or right), this system should be readjusted. It is desired that the range in the top of slot alignment be such that they appear off center approximately the same amount left and right from the center as the 15 slots move past the reader head top card guide.

10.3.5. Press **'Enter'** when done to save the adjustment.

Note: You may now replace the carousel access cover, rear access panel, close all the optics modules, release the card latch, and replace stacker tray.

10.4. Bottom Bias

The bottom bias is properly aligned when a carousel slot is centered in the autoloader opening at the bottom of the carousel during a carousel slot load movement.

10.4.1. At the **`Prompt>`** type **`"ALIGN_CARO_BOTTOM"`** and hit **`'Enter'`**.

10.4.2. Following the prompts on the screen, move the carousel left or right as needed so that the slots are centered with the card load opening in the bottom of the carousel. The alignment software will automatically move to the next slot each time you make an adjustment.

Tip: It is helpful to open the cassette load door half way and use a penlight to allow you to visually see how the carousel lines up with the autoloader opening in the carousel.

10.4.3. After completing alignment, press **`'G'`** to check all 60 slots on all four quads. Press the **`'Space Bar'`** to stop the slot cycling.

Note: Make sure this is done with the carousel moving in a clockwise direction.

10.4.4. After checking how the alignment looks on one complete quad, you may find it necessary to readjust to give the best overall alignment for all 15 slots. Readjust as necessary if this is the case.

Example: When verifying alignment of the 15 slots in a quad, you notice that the slots range from being centered to off in only one direction (left or right), this system should be readjusted. It is desired that the range in bottom of slot alignment be such that they appear off center by approximately the same amount left and right from the center as the 15 slots move past the autoloader opening.

10.4.5. Press **`'Enter'`** when done to save the adjustment.

11. Cam

11.1. Cam Selection

If aligning a 60 then skip this sub-section. If aligning a 120, this sub-section is required.

11.1.1. **For a 120**, at the **Prompt>** type **"CAROUSEL A"** and hit **'Enter'**. This will redirect all cam alignment commands to Cam A. You may complete the rest of this section to align Cam A, then return back to this point.

11.1.2. **For a 120**, after Cam A has been aligned, type **"CAROUSEL B"** and hit **'Enter'** to redirect all cam alignment commands to Cam B. You may complete the rest of this section to align Cam B.

11.2. Cam Stroke

The Cam is properly aligned when it will stop just short of pressing on the edge of a test card that is setting in the carousel slot in front of the reader head.

11.2.1. At the **Prompt>** type **"CARO_INIT"** and hit **'Enter'**. This will initialize the carousel and move it to slot 0.

11.2.2. Remove the incubator access cover and install an empty (blank) 64 well card into the center-most carousel slot of the exposed quad. Straw port will be down and facing out towards front of instrument.

11.2.3. At the **Prompt>** type **"CT 52"** and hit **'Enter'**. This will move the card directly in front of the reader head.

11.2.4. At the **Prompt>** type **"ALIGN_CAM"** and hit **'Enter'**.

11.2.5. Following the prompts on the screen, move the Cam in or out as needed so the Cam just does touch the card. The Cam should not apply any pressure to the card at all.

Note: Press the **'H'** key when done to cycle the Cam and verify the proper position during this alignment. Readjust if necessary.

11.2.6. Press **'Enter'** when done to save the adjustment. The Cam will cycle once.

11.2.7. At the **Prompt>** type **"CT 0"** and hit **'Enter'**. This will move the carousel so that you may remove the card easily.

Tip: If you will be performing the **Autoloader** alignment next you may leave the test card in the carousel as it will be needed for that alignment as well.

12. Autoloader

12.1. Autoloader Selection

If aligning a 60 then skip this sub-section. If aligning a 120, this sub-section is required.

12.1.1. **For a 120**, at the **Prompt>** type **"CAROUSEL A"** and hit **'Enter'**. This will redirect all autoloader alignment commands to Autoloader A. You may complete the rest of this section to align Autoloader A, then return back to this point.

12.1.2. **For a 120**, after Autoloader A has been aligned, type **"CAROUSEL B"** and hit **'Enter'** to redirect all autoloader alignment commands to Autoloader B. You may complete the rest of this section to align Autoloader B.

12.2. Autoloader Stroke

The Autoloader is properly aligned when it will stop just short of pressing on a test card that is setting in the carousel slot in front of the carousel load opening.

12.2.1. At the **Prompt>** type **"CARO_INIT"** and hit **'Enter'**. This will initialize the carousel and move it to slot 0. You may skip this step if you have just done this during **Cam Stroke** alignment.

12.2.2. Remove the incubator access cover and install an empty (blank) 64 well card into the center-most carousel slot of the exposed quad. You may skip this step if you have just done this during **Cam Stroke** alignment.

12.2.3. At the **Prompt>** type **"CB 52"** and hit **'Enter'**. This will move the card directly in front of the load slot at bottom of incubator.

12.2.4. At the **Prompt>** type **"ALIGN_AL"** and hit **'Enter'**.

12.2.5. Following the prompts on the screen, move the Autoloader in or out as needed so it just does touch the card. The Autoloader should not apply any pressure to the card at all.

Note: Press the **'H'** key when done to verify the proper position during this alignment. Readjust if necessary.

Tip: You may use a small pencil or screwdriver to move card to check for excess pressure from Autoloader.

12.2.6. Press **'Enter'** when done to save the adjustment. The Autoloader will cycle once.

12.2.7. At the **Prompt>** type **"CT 0"** and hit **'Enter'**. This will move the carousel so that you may remove the card easily.

13. Optical Shuttle

13.1. Shuttle Selection

If aligning a 60 then skip this sub-section. If aligning a 120, this sub-section is required.

13.1.1. **For a 120**, at the **`Prompt>`** type **`"CAROUSEL A"`** and hit **`'Enter'`**. This will redirect all shuttle alignment commands to Shuttle A. You may complete the rest of this section to align Shuttle A, then return back to this point.

13.1.2. **For a 120**, after Shuttle A has been aligned, type **`"CAROUSEL B"`** and hit **`'Enter'`** to redirect all shuttle alignment commands to Shuttle B. You may complete the rest of this section to align Shuttle B.

13.2. Shuttle Home Offset and Stroke

The shuttle is properly aligned when the reflector glass (dark glass) is centered with the interrupt LED when the shuttle is home. The shuttle must also center the solid reference standard glass (mirrored glass) with the interrupt LED when the shuttle is extended.

Caution: Be careful not to get fingerprints or dirt onto either glass. Clean only with lens paper if necessary.

13.2.1. Open the Fluorescence Optical Shuttle to allow you to view its movement.

13.2.2. At the **`Prompt>`** type **`"ALIGN_SHUTTLE"`** and hit **`'Enter'`**.

Note: The red LED on the shuttle should turn on during this alignment.

13.2.3. Following the prompts on the screen, first move the shuttle in or out as needed to center the reflector glass (dark glass) with the interrupt LED.

13.2.4. Press **`'Enter'`** when done to save this adjustment.

13.2.5. Now following the prompts on the screen, move the shuttle in or out as needed to center the solid reference standard glass (mirrored glass) with the interrupt LED.

13.2.6. Press **`'Enter'`** when done to save this adjustment.

13.2.7. Carefully close the Optical Shuttle using the latch to avoid possible damage to the optics.

14. Stacker

14.1. Stacker Selection

If aligning a 60 then skip this sub-section. If aligning a 120, this sub-section is required.

14.1.1. **For a 120**, at the **`Prompt>`** type **`"CAROUSEL A"`** and hit **`'Enter'`**. This will redirect all stacker alignment commands to Stacker A. You may complete the rest of this section to align Stacker A, then return back to this point.

14.1.2. **For a 120**, after Stacker A has been aligned, type **`"CAROUSEL B"`** and hit **`'Enter'`** to redirect all stacker alignment commands to Stacker B. You may complete the rest of this section to align Stacker B.

14.2. Home Offset

The home offset is properly aligned when the stacker pusher does not bottom against the stacker assembly.

14.2.1. At the **`Prompt>`** type **`"MN STACKER"`** and hit **`'Enter'`**.

14.2.2. Next at the **`Prompt>`** type **`"ALIGN_MOT"`** and hit **`'Enter'`**.

14.2.3. Following the prompts on the screen, move the stacker pusher in or out as needed so the back of the pusher just touches the stacker housing.

Note: Press the **`'H'`** key when done to re-home the stacker. Verify the back of the pusher does not hit or bottom hard against the stacker housing. Readjust if necessary.

14.3. Tray Switch

The tray switch is properly aligned when it detects the presence or absence of the tray.

14.3.1. At the **`Prompt>`** type **`"N_STACKER SPN_SENSORS"`** and hit **`'Enter'`**. This will switch to the SPN board controlling the stacker and display the status of its sensors.

14.3.2. Loosen the two small screws holding the stacker tray micro-switch.

14.3.3. With the stacker tray fully seated into stacker, adjust the micro-switch in or out as needed until the terminal screen indicates the stacker tray is present.

14.3.4. Tighten the two screws holding the micro-switch.

14.3.5. Press the **`'Space Bar'`** to end the **SPN_SENSORS** command and get the **`Prompt>`** back.

15. Alignment Completion

This section will go through the necessary steps after an instrument has been aligned either in part or completely. This section will have to be performed after completion of alignment, prior to the instrument being used.

15.1. Firmware Configuration

The firmware must be taken out of alignment mode after it is aligned. Failure to do so will result in the instrument not operating correctly.

15.1.1. Consult latest revision of document **VK2PRM** for variable adjustments prior to next step.

15.1.2. At the **`Prompt>`** type **`"SAVE_ALIGNMENT"`** and hit **`'Enter'`**. This will save a copy of the alignments for all nodes (SPN boards) to the Bay Controller Board (BCB).

15.1.3. At the **`Prompt>`** type **`"ALIGN_MODE_OFF"`** and hit **`'Enter'`**. This disables alignment mode and reboots.

15.1.4. Wait for completion of the reboot before using the instrument.

REVISION HISTORY

REV	PCN NO.	DATE	BY	DESCRIPTION
D	I00-0035	2/02/00	S. HIGGINS	Change to the following: 4.1.8. Press the "R" key three times to move the boat so the card separator is at card positon 4. Verify correct position by looking at reported position on the diagnostic terminal.
C	I99-0482	11/19/99	D. HOPPER	Numerous changes are being implemented to this assembly drawing and related test procedures. See attached data summary sheets for details.
B	I99-0274	05/17/00	J. P	Add info regarding VK2PRM
A	I99-0073	02/03/99	B. FREINER	Alignment procedure, add 120 info, add new bar code alignment, add minor updates and clarifications
NEW	I98-0003	01/02/97	J. GRUBER	Create new alignment procedure for Vitek 2 instrument.

Appendix F: **Fluorescence Optics Calibration**

NOTE: The following text of this appendix is for INFORMATION PURPOSES ONLY. Always refer to the Official Release Document for the approved Alignment Procedures. See Document Control for the approved drawings.

APPLICATION		REVISIONS			
NEXT ASSY	USED ON	LTR	DESCRIPTION	DATE	APPROVED
		C	SEE MASTER COPY (PCN #I99-0050-1) BF	1/26/99	
		D	SEE MASTER COPY (PCN #I99-0398-1) SH	9/3/99	
		E	SEE MASTER COPY (PCN #I99-0482-4) DAH	11/22/99	

FILENAME: 530601E.DOC

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DRAWN	D. SHINE	11/24/97	**bioMérieux, Inc.**
CHECKED	Brent D. Freiner	1/12/98	595 Anglum Road
APPROVED	Mark Fanning	1/20/98	Hazelwood, MO 63042-2320, USA
APPROVED	Ray Shelton	1/21/98	TITLE:
APPROVED	Don Hellmann	1/21/98	VITEK 2 FLUORESCENCE OPTICS
APPROVED	John Bryant	1/21/98	CALIBRATION PROCEDURE
APPROVED			SIZE DRAWING NO. REV.
APPROVED			A 530601 E
APPROVED	Ron Robinson	1/13/98	SCALE: FULL DIST. 1 SHEET 1 of 5

INDEX OF ACTIVE SHEETS

THIS INDEX LISTS THE REVISION STATUS OF THE SHEETS OF THIS DRAWING.

SEE SHEET 1 FOR DRAWING REVISION STATUS.

SHEET NO.	REV LTR	SHEET NO.	REV LTR	SHEET NO.	REV LTR	SHEET NO.	REV LTR	SHEET NO.	REV LTR
1	E								
2	E								
3	E								
4	E								
5	E								

1. REFERENCE DOCUMENTS

1.1. 510731, ***VITEK•2*** User's Manual.

1.2. 530600, ***VITEK•2*** Alignment Procedure.

1.3. TSTP530120, ***VITEK•2*** Fluorescence Optics Test Procedure.

2. REQUIRED CONSUMABLE SUPPLIES

2.1. 005080-1, QC-F Calibration Kit

2.2. 3 - 12 x 75mm Plastic Test Tubes

This kit consists of three Vitek 2 cards covered with BOPP tape with a fluorescence calibration card bar code label applied and three vials of 5µM 4MU solution.

PROTECT LIQUID FROM LIGHT WHEN NOT IN USE.

INSURE THAT THE LIQUID HAS REACHED ROOM TEMPERATURE BEFORE USING.

USE THE CALIBRATION KIT ONLY ONCE.

.30 Black Test Card, Fixture # 371233

3. INTRODUCTION

PERFORM CALIBRATION PROCEDURE WITH ALL PANELS INSTALLED AND ALL DOORS CLOSED.

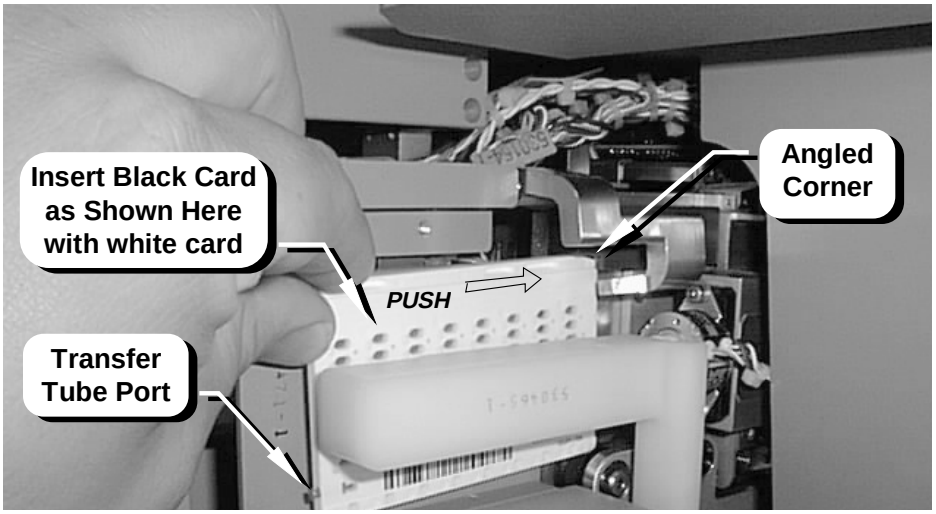
WAIT ONE HOUR FROM INSTRUMENT POWER-UP, PRIOR TO PERFORMING CALIBRATION.

3.1. If the operational status of the instrument is unknown, type the command **`"inst_defaults"`** at the DML prompt to reset all the system variables to their default state.

3.2. Check the optical shuttle alignment using the procedure outlined in the Vitek 2 Alignment Procedure.

3.3. Set the Fluorescence card reading position (called FSTEPS) using the following procedure. Access the service menu on the User I/F by typing 7378 on the root menu screen and pressing ENTER. Choose the "Load a Card" menu item and select one card for one cycle as card type 4. Before you answer yes to load the card, insert a black card into the reader head through the Stacker. The angled corner of the card should be on top and inserted into the read head first. Transfer tube port will be down and out. (See figure below). Once the card is inserted, you may answer yes to load the card. This process takes approximately eight minutes. **Wait until the black card has finished processing and the instrument emits a series of tones before continuing.**

Note: If the black card ejects accidentally before completing, you will not hear the tones. In this case it will be necessary to reload the black card as instructed above so it can complete normally. It may also be necessary to use the **"zeroslot"** command to clear a terminated card from the carousel status.



3.4. Fill each test tube with one vial of 4MU solution and put the filled tubes in positions 1, 2 and 3 in the Vitek 2 cassette (be sure the cassette's memory has been erased). Install the cards with transfer tubes in the corresponding slots in the cassette.

3.5. If not already, place the instrument into "Cassette Only" mode by pressing **[UTILITIES] [CONFIGURATION] [CASSETTE MODE] [CASSETTE ONLY]** on the User Interface Menu.

3.6. Open the load door, put the cassette into the Vitek 2, and close the load door. The instrument will immediately begin processing the cassette. During this time the instrument will run the vacuum cycle twice - this is normal. The calibration cycle takes approximately 15 minutes.

3.7. At the conclusion of the calibration the cards will be ejected into the stacker waste tray. Any failures will be indicated on the LCD display. If the calibration was successful the instrument will emit a series of tones. Remove the ejected cards. Be sure to leave the instrument in the same mode as you found it (Cassette Only or Smart Carrier).

Appendix G: **Installation Check List**

	Place ***VITEK•2®*** in its permanent location.
	Verify all outlets for proper grounding and then properly connect all cables except for the instrument communications cable. (This will be done after configuring the tty serial ports.) (See Figure 2-2 to 2-4)
	Place the Smart Carrier Station (SCS) in its working location and connect it to a power outlet. (Do not connect SCS to Work Station. It only needs to be connected when the SCS needs a firmware update.)
	Turn on SCS, verify proper operation, verify all cassettes with button memory can be read and record firmware version. SCS Program Version _____
	Turn on ***VITEK•2®*** Instrument (and Work Station if applicable).
	Remove shipping foam block from beneath ***VITEK•2®*** vacuum chamber.
	Clean Vacuum Seal, all boat surfaces and all optics assemblies.
	Install Drum, Magazine Assembly and Motor Shield.
	Install Quads, Incubator Cover & Boats using the ***VITEK•2®*** User Interface.
	Configure Work Station to communicate with ***VITEK•2®*** and SCS using **vt2setup**. (Only define the ports which will be used by the ***VITEK•2®*** and SCS.)
	Physically connect the communication cable from the appropriate tty ports on the Work Station to the ***VITEK•2®*** instrument. (See Table 2-2.)
	From **vt2setup** associate the installed instrument with a button on the ***VITEK•2®*** Work Station software. (Verify the instrument association from the Work Station software.)
	Setup and verify remote diagnostics. (For security purposes, turn modem off when not in use.)
	Verify proper function of Optics, Card Transport & Vacuum from the User Interface of the ***VITEK•2®***.
	With diagnostic window opened on the Work Station verify **sys_status** and proper fan operation. (**fan 100**)
	Record the instrument firmware versions of BCB, BOOT & SPN. (**ver**) BCB _____ BOOT _____ SPN: ltrans ____ rtrans ____ dil ____ pip ____ vac/seal ____ reader ____ cara a ____ cara b ____
	Verify proper incubator temperature. (See specification.) (From User Interface: Utilities, Diagnostic, Temperature)
	Verify vacuum level obtained is 0.89 ± 0.04 PSIA by connecting Absolute Pressure Gauge and performing vacuum cycle. (vac_cycle)
	With diagnostic window opened, run engineering test cards and verify proper alignment and operation of instrument. (See current revision of drawing 530600.)
	Perform F-steps & Fluorescence Calibration. (See current revision of drawing 530601.)